POPULAR MECHANICS

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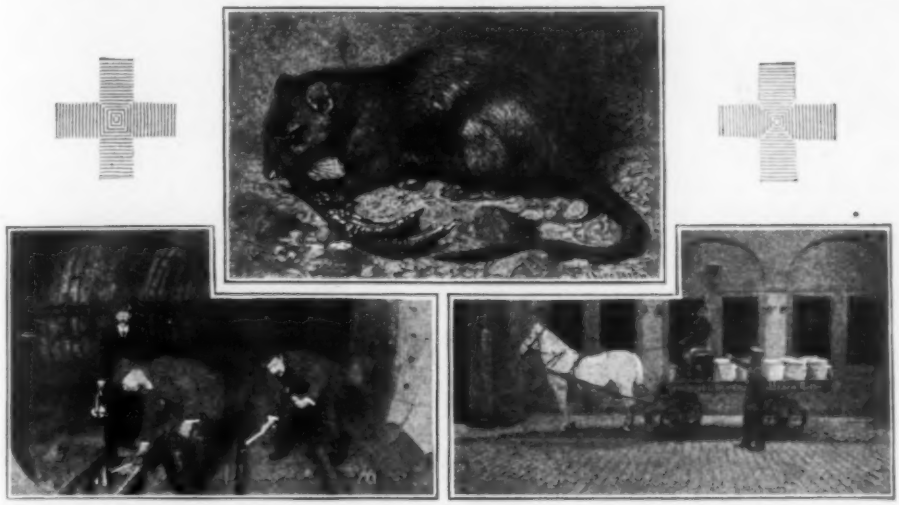
BUBONIC PLAGUE A DISEASE OF RATS

War of Extermination Waged by Nations and Cities—Rat Population Larger Than Human Population—Concrete Construction Great Aid in Extermination —Rapid Transportation from One Side of World to the Other Responsible for Many Epidemics



Laying Virus for Rats in the Underground Railways, London

One of the Dead-Carts for Rats; Health Department, Denmark

Denmark, England and some of the western cities of the United States, wise in their generation, have commenced a war of extermination against rats, with the hope of eventually eliminating all danger of great bubonic plague epidemics.

In one of the leading cities of the west cases of plague were discovered in 1903 and after a short campaign of rat extermination the epidemic was considered under control, only to break out again and again. This city has now declared actual war upon its rat population and a force of 100 men is employed setting and handling traps as well as distributing rat poison. To encourage the populace in the war a bounty of 25 cents for every male rat and 50 cents for every female rat is paid to any person bringing in a carcass. During the earlier months of the year rats were killed at the rate of 2,500 a day.

It is not generally known that the bubonic plague is a disease of rats, but such is the case. While it is a most deadly menace to the human family it does not, as a rule, spread from one such person to another. When the world becomes thickly populated with rats some incubating spot in India or some other tropical country produces a germ of sufficient virulence, the rats become infected, and the epidemic sweeps over the rat-infested world.

Most disease germs are taken into the human body through the mouth or respiratory passages and these doors can be guarded, but the plague germ can penetrate the skin without an abrasion, thus its great danger. The plague germ

is of peculiar structure and can be easily recognized under a microscope. However, because of the great mortality of those afflicted and the great fear of the disease, health officers hesitate to reveal its presence. This unwise course gives the infection time to spread and renders its control more difficult.

Few people realize the enormous number of rodents which infest the centers of population. The rat population is much larger than the human population. Not only in the cities but in the country, the warehouses, railroad cars, boats and packing houses are breeding places. From the producer to the consumer human food is preyed upon, run over and eaten by rats. Nocturnal in their habits they infest houses, barns, and alleys without human knowledge. Burrowing under houses and walks they breed with great rapidity. When a rat becomes sick with the plague it travels along the numerous runways, scattering plague infected fleas, and at last dies in some inaccessible spot under some building. Here in its dead body the germs are preserved for months and at last blown along in the dust. Therefore it is necessary not only to destroy the life of the rodent, but its carcass as well.

Denmark was aroused to the danger of rats by the arguments of Dr. Zuschlag, who convinced the government after months of ridicule that the rat was the source of trichinosis, and that they annually destroy material worth $2,500,000. The government put a premium on every dead rat. When a rat is turned in its tail is cut off, and carcass and tail are put into separate air-tight receptacles. Each night the tails, which serve as a receipt, are counted and then burned with the carcasses at the local gas works. In London a like crusade has been instigated by the management of the underground railways, and every night after traffic has been suspended, an army of men distribute virus in the tubes. After a few days the rats feel ill and seek the open air to die apart from their fellows. The virus is harmless to other animals and men.

The United States Department of Agriculture estimates that rodents annually destroy more than $56,000,000 of food value in this country. As is well known, every great epidemic of plague in Asia has been ushered in by the death of innumerable rats from the same disease. With such a medium to carry an infection of most deadly nature, for the records show that every other person stricken dies, and no successful antitoxin yet produced, the situation is certainly grave.

The remedy which promises most is the removal of rat producing conditions, and here concrete comes to the front again, as the substitution of concrete in all surface and underground construction is the rat's greatest foe. The rat revels in wooden structures and when we have more cement wharves, and stone, brick, concrete and steel buildings the rats will be fewer.

Epidemics, like the great prairie fires which used to sweep over the western plains, are dependent on conditions which produce material upon which to feed. Man is responsible for some of these favorable conditions and the others are independent of him. Typhus fever can only exist in the presence of human filth. Enough babies are born in Chicago and enough vaccinations lose their effective properties to produce material for a smallpox epidemic every 8 years.

The trend of the present age is to a great extent responsible for the outbreak of epidemics in parts of the world never before so afflicted. The world is growing smaller, as year by year modern transportation methods cut weeks and days from the time it once took to travel from one part of the world to another. Not so many years ago it took weeks to cross the oceans and almost as much time to cross the American continent. Today the Atlantic ocean is crossed in less than five days, and the American continent in the same time. The result is obvious. By the old slow transportation methods persons infected by a disease in some distant country, either died or became well in the weeks and months of travel necessary to

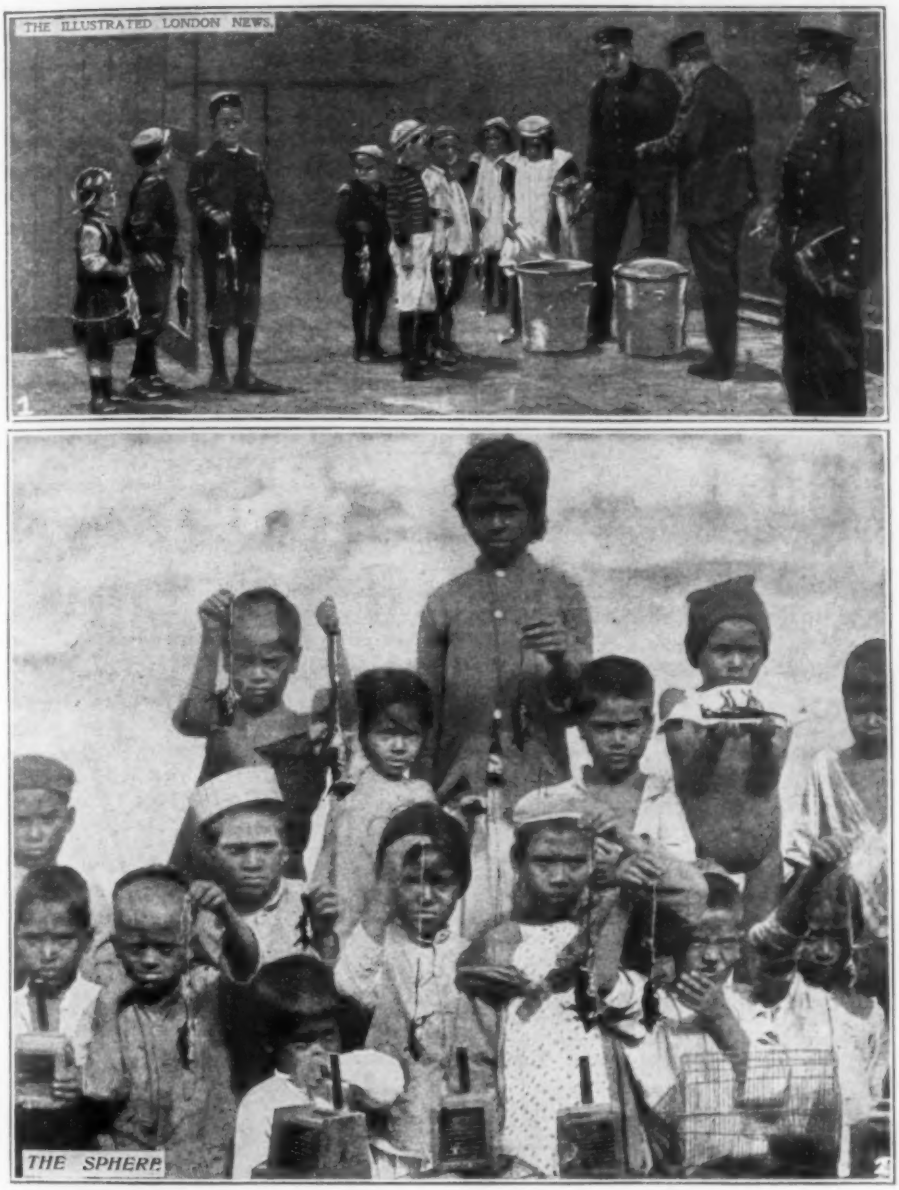


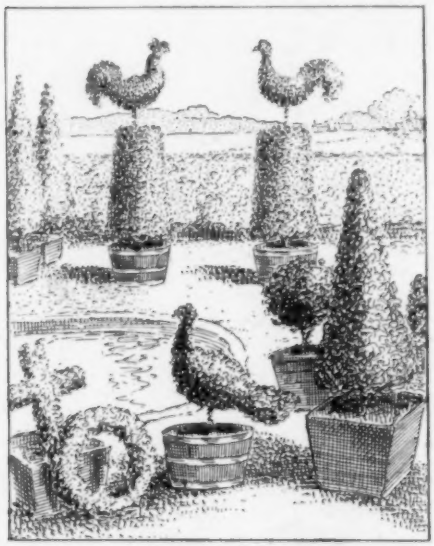
Fig. 1—Danish School Children at Fire Station in Copenhagen receiving bounty of 1 penny for each dead rat. The tails are then cut off and sent to headquarters as a voucher for money paid out.

Fig. 2—Children at Health Office, Bangalare, India, bringing in their captures. A small bounty, about one-fourth of a cent in U. S. money, is paid for each rat.

reach other parts of the world. Today people can leave Russia or some as far distant country and arrive in the United States after hardly more than two weeks of travel, bringing with them in virulent form the diseases there prevalent. It is claimed that grippe was in such manner first brought from Russia to this country, where it has since thrived with such fatal results.

ROYAL HORTICULTURAL SHOW

The annual show of the Royal Horticultural Society of England, held recently in the Temple Gardens, was con-



Fantastic Foliage

sidered exceptional as an exhibition of rarities in new colors, scents, forms and varieties. The ornamentally sheared trees shown in this illustration afforded much amusement to the "Dewan of Natal," and Prince Hiroyasu Fushimi of Japan, because of the fantastically shaped tops, especially those resembling a well known barnyard fowl.

FISHING ON HORSEBACK

After a big storm on the Pacific coast an enormous number of squid are usually driven inshore and tumbled about by the breakers. When such occurs every man or boy in the California towns nearby, who can beg or borrow a horse, goes galloping down the beach armed with a 6-ft. bamboo pole, at the end of which is a strong steel hook. They dash into the surf and driving the sharp steel into the squirming jelly-like creatures, haul them ashore one by one, with their sucker-rimmed arms coiling about like snakes. They sell for about 25 cents each.

BURNING FIRE BOX SENDS IN OWN ALARM

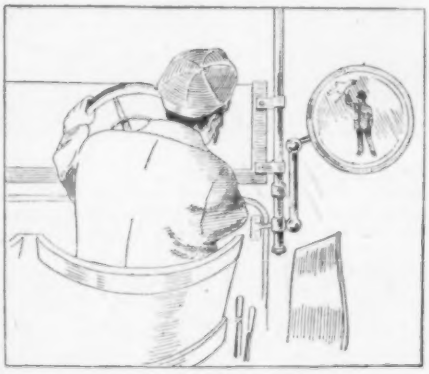
Box 32 of the Haverhill, Mass., fire alarm system had a fire all by itself one morning recently and sent in its own alarm, followed a few minutes later by another alarm. There was great excitement for a time, as gas blew up through the box from the conduits and bursting into flame shot high into the air, melting the contact points in the box and doing other damage. The cause of the fire was a break in a trolley wire.

CITY MAIL CARRIERS MAY HAVE WAGONS

The postoffice department is considering the advisability of having the outlying districts of a number of the cities of the country covered by mail carriers with wagons. If the experiment is tried the carriers will ring a bell as they pass along, warning the residents to get their letters ready.

AUTOISTS "SPOT" POLICE WITH REFLECTORS

One of the numerous ways by which autoists succeed in foiling the attempts of the police to catch them exceeding the speed limit, is a large reflector fastened to the dashboard of the automobile. In catching the time of a speeding car the police usually set their trap

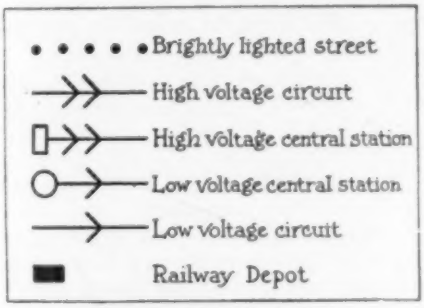


Seeing Without Turning

along a stretch of straight road, and as the automobile passes, one policeman steps out into the road and waves his arms to signal the next officer. This action can be seen in the reflector and if the autoist is cautious he immediately slackens speed and slowly rolls past the other end of the trap in triumph.

SYMBOLS ON AERONAUTICAL MAPS

In preparing the aeronautical maps for the use of aeronauts making night trips and when in strange localities, the commission appointed by the International Aeronautic Federation has recommended the adoption of 40 standard symbols for indicating various land-



Maps for Aerial Navigation

marks and points of danger. Many of the symbols will show landmarks visible from a distance by day, and others will designate electrically lighted streets, blast furnaces and other illuminations which serve as guide-points by night. Four of the symbols will designate electric power houses and overhead circuits, which might prove dangerous both day and night if landings were attempted in their vicinity. Six of the symbols are here reproduced.

CABLEWAY OVER FLOODED DISTRICT

During the last great flood of the Colorado river, when the water cut great gashes through the valleys of Southern California that lie below sea

The River is 300 Ft. Wide

level near the Mexican boundary, this novel carrier was constructed to convey freight and passengers over a gorge 100 yd. wide, not far from the town of Brawley. Horses and cattle even were transported over the flood, as there was no other means of crossing without going fully a hundred miles around. All such ordinary floods have since been entirely checked at a cost of millions of dollars, but the cableway is still kept ready for business.

HIGH-SPEED MOTOR BOAT

These illustrations show a powerful though small racing motor launch. Its speed is 25 miles an hour and it is equipped with a 40-hp., 4-cylinder engine. It has a length of 26½ ft. and a beam of 3½ ft.

Courtesy Ringling Bros.

The camel has always been an important part of a circus parade, but, like the elephants, they have usually been driven unattached to any vehicle. In this illustration they are shown harnessed to one of the heavy animal wagons.

MECHANICAL FEATURES OF A GREAT CONVENTION

One of the most dramatic scenes of the Republican national convention held in Chicago was the tribute to President Roosevelt, when for 52 minutes the thousands in the huge coliseum forgot the heat and the discomfort of being packed like sardines in a box and sent forth a mighty and prolonged shout of enthusiastic homage. The ovation was intensely human, but the means by which President Roosevelt heard it 790 miles distant in Washington was mechanical.

A great Chicago newspaper had hung four powerful and sensitive transmitters in front of the speaker's stand, so that men in the newspaper office as well as in the convention hall could hear and write down the speeches. Just before the long expected ovation started, one of the wires connecting with these transmitters was "cut in" to the White House and "Mr. President" heard, and some say he grew worried.

The transmitters were four black discs, hung 10 ft. above the stand, and looped by wires which were joined in a small cable. A combination of telephone and phonograph, they took up the proceedings, transmitting each swell of oratory and each throb of applause. Thus, by a mechanical agency were the conventions (this is not a pun) circumvented without affront to custom. Convention etiquette prohibits the presence of the president and the presidential candidates at the convention itself, but does not attempt to exert jurisdiction over any mechanical device which might take the convention to them.

In addition to this device were direct telephone wires from the convention hall to the White House and to Mr. Taft's headquarters in Washington, as well as direct telegraph wires operated by the two big companies. The other presidential candidates also had direct telephone or telegraph wires running into their offices or homes. In handling the press news and other dispatches the telegraph companies used 124 lines. Pneumatic tubes carried the copy of the newspaper men from the press section to the telegraphers in the basement.

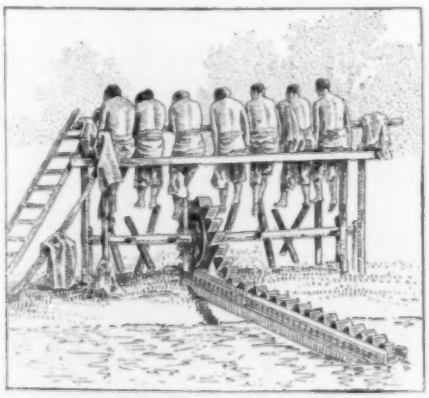
For the internal working of the convention, very few mechanical aids were required or provided. In a corner of the annex of the huge building was located a large hospital room which cared for at least 25 persons, the majority of whom had fainted in the crush or been prostrated by the heat. Connecting with this room were push-buttons placed in different parts of the building for the purpose of calling the corps of attendants where needed. A large red signal lamp was placed over the speakers' stand to call all the physicians in the hall if a serious accident should occur. Almost under the feet of the bandmaster was another signal

to tell him when to start or stop the music. Electric fans at the corners of the speakers' stand kept the air in motion.

While not directly connected with the working of the convention itself, the outside presented quite as interesting a field for the mechanical. During the nights a huge kite, of the kind used in aerial advertising, flew over the city with a large electric sign attached to it. The sign bore the name "Taft" and the letters, composed of 200 electric lights, were 10 ft. high. The electric wire was handled in the same manner as the kite string. Another kite bore aloft a canvas on which was painted a likeness of Mr. Taft. A powerful searchlight was played upon this from the top of one of Chicago's skyscrapers. A mechanical campaign orator also attracted much attention on the streets. It was a huge gramaphone mounted on a wagon.

CHINESE TREADMILL

In many parts of China water is pumped in the manner here shown. The men sit on a narrow platform above the wheel shaft and as the cross pieces or pedals attached to it come uppermost they push them down with their feet. Pumping a bicycle up a steep hill is mild exercise compared to this irrigation proposition. This treadmill work is done by free men for wages.



Primitive Power Plant

COOKING WITH HIGH EXPLOSIVES

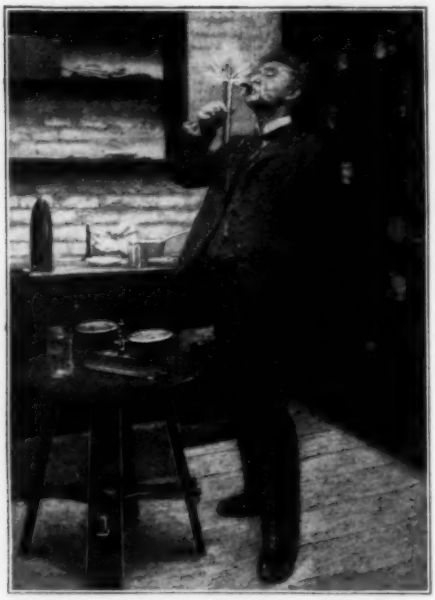
By P. Harvey Middleton

One would hardly expect the old saying that "familiarity breeds contempt" would be applicable to high explosives, and yet under certain conditions one can take the most unheard of liberties with this death-dealing material. This was proved to my entire satisfaction recently when I visited Hudson Maxim at his residence in St. Mark's avenue, Brooklyn, N. Y.

Maxim in His Laboratory

On being ushered into his home I found the rooms tastefully decorated with implements usually identified with destruction. The parlor fender, for instance, was flanked with two gleaming Maximite shells, and on the walls hung ancient flintlocks and modern guns interspersed with choice engravings and Venetian glass.

Passing through into the laboratory I found the inventor of the most deadly explosive in the world calmly engaged in the apparently perilous occupation of frying eggs and bacon in a pan over blazing Maximite—stuff which will rip



Lighting a Cigar with Burning Explosive

out the bottom of the biggest battleship afloat or tear a gaping hole in a 12-in. steel armor plate.

"Oh, that's nothing," said Mr. Maxim, when I expressed my astonishment. "I'll make you a cup of coffee in the same way in a minute.

"You see, it's quite simple," continued Mr. Maxim. "Maximite is quite harmless without its detonating fuse, and is as safe and manageable a kitchen fuel as a stick of wood, and far quicker, for it always lights directly you apply the match."

We must not draw the hasty conclusion, however, that Mr. Maxim recommends his explosive for housekeeping purposes. He merely wished to emphasize the fact that without the fuse there was no danger at all. If detonated with the right fuses there was enough explosive under those eggs to blow every house in the block heavenwards.

In the garden some wet guncotton was hanging out to dry, looking as innocent as an eiderdown cloak, while on the ground were numerous ends of smokeless powder candles and rags of guncotton. Mr. Maxim showed his contempt for nitrogelatin by hammering nails into a wall with a big chunk of it, which he afterwards sawed up for kitchen fuel.

Returning to the drawing room, we found Mrs. Maxim cheerfully inducing a dainty copper kettle to boil over a yellow cake of Maximite, while a Welsh rarebit was being done to a turn over a dish of smokeless powder.

"Maximite," said Mr. Maxim, as he casually lit a cigar after tea with a candle of the high explosive, "cannot be exploded by ignition, nor can it be heated hot enough to explode, as it will boil away like water under heat. It is therefore perfectly safe to melt over an open fire for filling projectiles in the same manner that asphalt is melted in a street caldron.

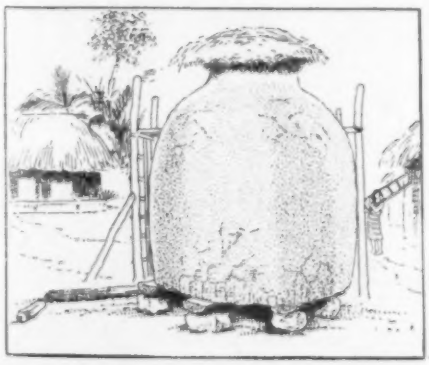
"It is, in fact, a deadly paradox. You can pour molten cast iron upon a mass of it without causing an explosion, but fit a detonating fuse to it and you can shatter a fortress. A year or so ago I was standing in the naval laboratory at Portsmouth, England, watching an elementary demonstration of the principles of torpedo practice and submarine mining. My companion took up a piece of guncotton and applied a light to it. It flared up fiercely enough, but that was all. Subsequently I saw 200 lb. of it, which had been sunk in a creek, exploded, and the water was thrown up in a column 80 ft. high, blackened here and there by fragments of what had been a whaleboat a moment before."

Picric acid is another deadly but ec-

Armor Plate "Maximited"

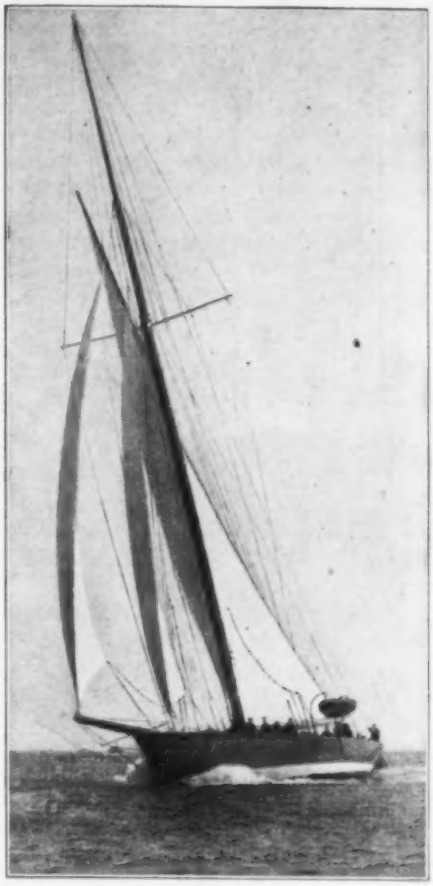
centric explosive. If placed on an anvil and struck with a hammer it will go off. If heated in a pan over a fire it will simply evaporate, but if dropped into a receptacle at the same temperature it will explode violently.

Lyddite, which is a form of picric acid, used by the British government, may be placed in a die into which a punch descends with great force, or it may be placed on an anvil and given a mighty blow with a sledge hammer, but there will be no explosion. It may be mixed with gunpowder and the gunpowder exploded, but the lyddite will remain as before. You can use it to light a cigar, cook a meal, or boil water, but when exploded in the proper way its effects are simply terrible. Sir Andrew Noble confined lyddite in a cast-iron shell and exploded it in a chamber of steel. Afterwards he found a black mass in the chamber which he at first thought to be unconsumed carbon, but when he tested it with a magnet he found it was the cast-iron shell reduced to dust by the shock. A large shell loaded with lyddite was fired at a target 1,500 yd. away. When it burst, fragments of the shell were thrown nearly half a mile back towards the gun, while scraps of steel were thrown sideways for nearly a mile.



PROTECTING FOOD IN AFRICA

In east Africa grain is stored in this curious mud jug or safe to protect it from the white ants. Each little thatched native village has a number of such receptacles.

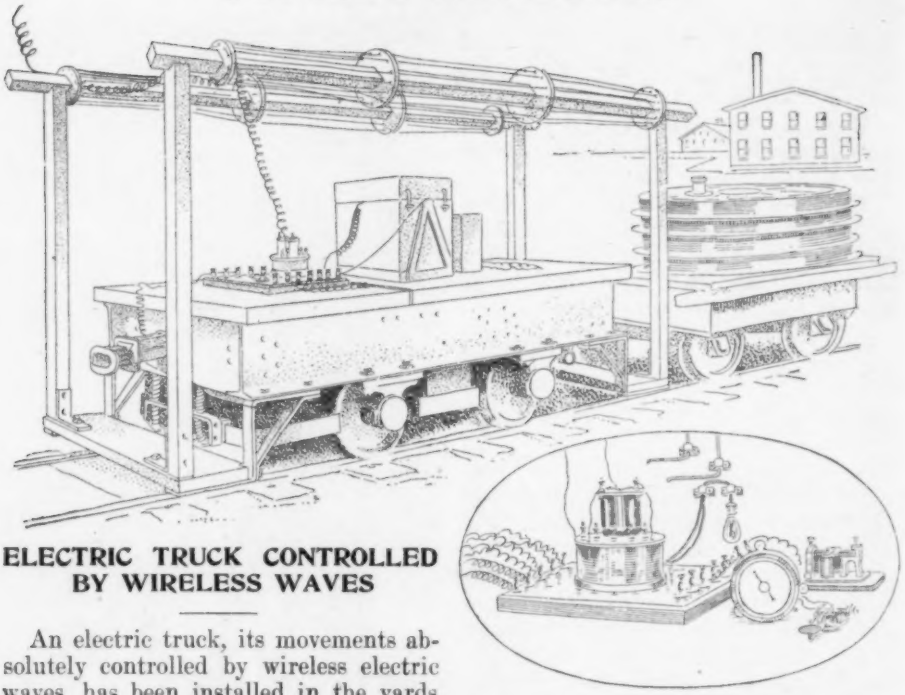


"SHAMROCK IV"

Sir Thomas Lipton's latest challenger for the America cup is here shown in one of her trials off Cowes. She is the fourth of the "Shamrock" dynasty.

LARGEST NAVAL DRYDOCKS

The work of building the U. S. naval drydock at the Bremerton Yard, Puget Sound, was commenced in July. The revised specifications completed a short time ago by Rear-Admiral Holliday, chief of the bureau of yards and docks, will make it the largest naval drydock in the world. An appropriation of $1,500,000 is available for its construction, which is expected to be completed in 18 months.



ELECTRIC TRUCK CONTROLLED BY WIRELESS WAVES

An electric truck, its movements absolutely controlled by wireless electric waves, has been installed in the yards of the Union Pacific Railroad at Omaha, where its operations startle the uninitiated. To see a motor truck, attached to several other trucks, heavily loaded, start along the tracks or suddenly stop without any apparent cause, making its way through the big yards unattended, is sufficient to startle most people.

The truck weighs 3 tons and is capable of hauling at a speed of 6 miles an hour a load of 10 tons on its own frame, and an equal load on the small cars which are included in the equipment. The motive power is furnished by batteries, and the wireless connection simply throws this power on or off.

Arranged over the top of the truck is an antenna, composed of 144 ft. of copper wire, by which the electric waves are picked up and transmitted to the starting and stopping gear of the motor.

A similar antenna, built in the form of a cylinder and attuned to the electric truck, swings from a 65-ft. pole at the central station, and from this flow the waves which control the mechanism of the car. The operator in the tower turns a switch and the electric waves flow from the antenna, to be picked up a moment later by the network of wires over the car. The car starts silently down the tracks and when its destination is reached the wireless waves are stopped and the connection broken.

FELLING TREES ON SWAMP-LAND

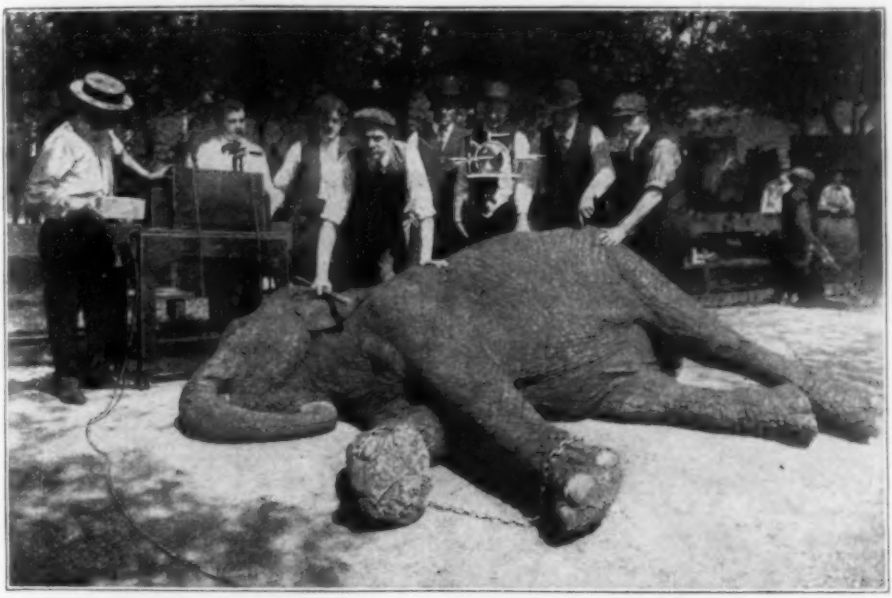
In parts of the Northern River district of New South Wales the swampy

Lumbering: New South Wales

condition of the ground makes it almost impossible to fell the big trees by chopping close to the base. This scheme of constructing a crude platform on which the choppers stand has therefore been resorted to.

PHOTOGRAPHING AN ELEPHANT WITH X-RAY MACHINE

In an effort to locate a diamond ring valued at $450, which an elephant had swallowed while being fed peanuts, three expert X-ray operators and four elephant trainers worked an entire day in Cincinnati recently, photographing the interior of the huge animal. This was the first time in the history of the science that X-ray photographs have been made of such a subject.



Photographing Insides of an Elephant to Locate Lost Diamond

To locate the position of the missing ring the side of the elephant was marked off into sections and numbered. A diagram was also made with corresponding numbers. It was necessary to allow the elephant to become accustomed to the crackling of the X-ray coil before it would consent to lie down upon the plate holder containing the sensitive plate. This took almost an hour. Another hour was spent getting the animal accustomed to the glare from the tube. This was at last accomplished and the elephant lay comparatively still until several plates were exposed. The beast then received a shock from one of the wires leading to the tube, and broke away. The trumpeting was almost deafening and only the quickest movements on the part of the attendants saved the machine from wreckage. It took a liberal portion of hay and about 3 lb. of sugar before the animal would allow itself to be led back to the scene of operation. In making the plates the largest X-ray apparatus ever manufactured was used.

NEWS STANDS AT SEA

For some time past the stewards on the ocean liners have added to their earnings by laying in a stock of periodicals and books and retailing them to passengers, but the regular newsdealer has only just arrived. On such ships as the "Lusitania" and her sister ship, it is quite a pleasant shock on the second day out to come across the

newsdealer's stall at the entrance of the barber shop or some other as natural place. The papers, it is true, do not bear the morning's date, but the magazines are of the last issue, and the novels the latest from the publishing houses.

The stall is entirely new and whether it has come to stay or not depends upon whether it pays. The rent is high, and besides paying for the privilege, the dealer must also pay his passage.

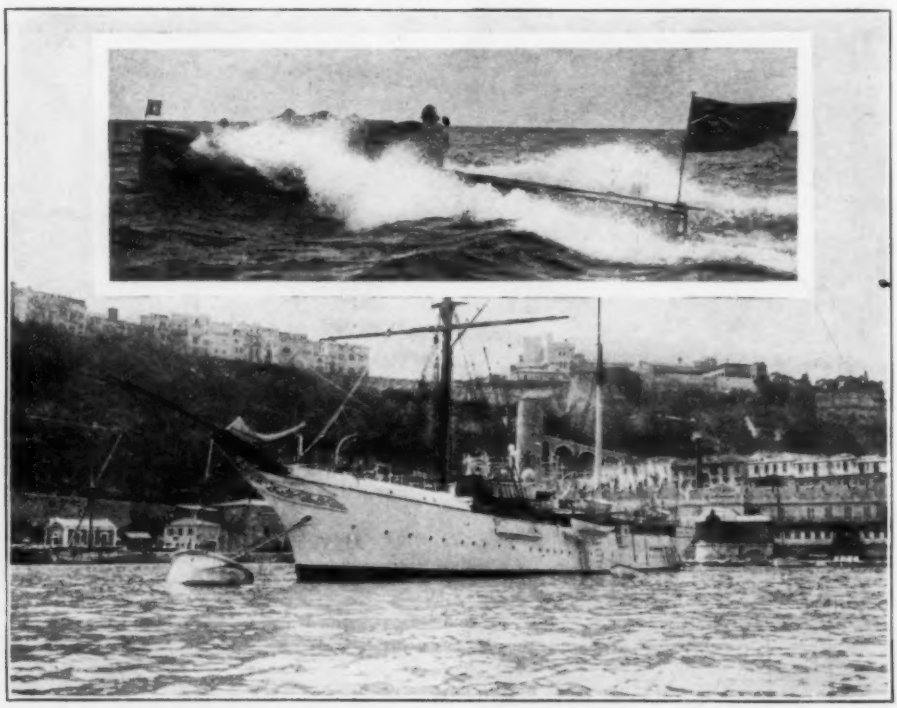
ORDERS SENT TO BALLOON BY WIRELESS

The army signal corps officers at Washington have been making successful experiments in sending wireless messages to balloons flying 1,500 to 2,000 ft. high. The antenna, which on the usual wireless station extends upward, hangs downward from the balloon for a distance of about 100 ft., and the balloon basket is covered with a wire netting. Only the receiving apparatus was carried by the balloon, as the sending apparatus was likely to produce sparks which would be a menace to the aeronauts.

HOW THE STARS ARE COUNTED

The gigantic task of counting all the stars in the heavens and assigning to each its proper magnitude is one that demands the quality of almost infinite patience, and without the art of photography the task would be almost impossible.

Photographic plates covering the whole of the southern hemisphere have already been secured, and these with the series dealing with the northern hemisphere will number more than 200. Each plate, which is 15 in.



The water scenes at Monte Carlo, the greatest gambling center in the entire world, are both varied and interesting. It was over the stretch of water shown in this illustration that Santos Dumont made many flights in his dirigible balloons. One of the illustrations shows the Prince of Monaco's yacht "Princess Alice", with his castle and the gambling pavilions in the background. The other is a photograph of the fast English motor boat "Wolseley-Siddeley" racing in the famous motor-boat regatta annually held there.

square, records from 20,000 to 250,000 starry images, and on a rough calculation the total number of stars photographed will be about 23,000,000.

The task of counting the stars on the plates has already been commenced, and this work, together with the cataloguing, will take at least 10 years.

WHEEL STANDARD FOR RURAL MAIL BOX

The owner of the property on which this rural mail box stands found that

Revolving Mail Box

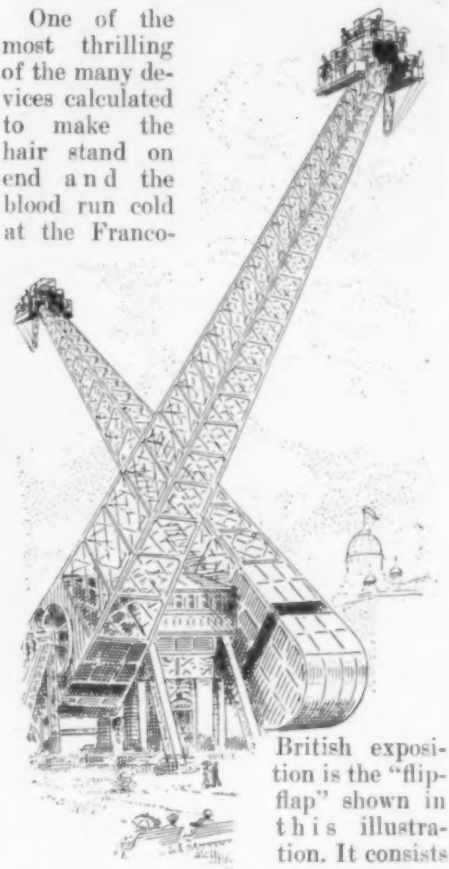
every post he erected was broken off by people turning the corner on horseback or with teams. He therefore took a buggy axle with both wheels attached, buried one wheel as a support, and placed the mail box on the other. Horses brushing against it in the dark simply give the wheel a whirl and are shied off into the roadway, while the mail carrier easily brings the box into position by giving the wheel a turn.

FREAK LOCATION OF MASTS

A remarkable feature in the construction of the 16,000-ton battleship "Michigan," launched the latter part of May, is the arrangement of her masts, which are not in line fore and aft, the mainmast being placed on the port and the foremast on the starboard side. This is an experiment adopted to give a freer range for the handling of her big guns, which are arranged in pairs in four large turrets, the after turrets being elevated sufficiently over the forward ones to enable all the guns to be fired simultaneously as a broadside, to port, starboard or forward.

THE "FLIP-FLAP" THRILLER

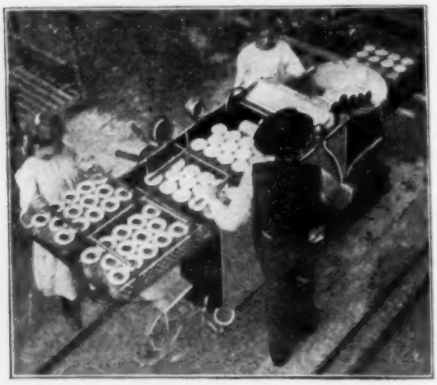
One of the most thrilling of the many devices calculated to make the hair stand on end and the blood run cold at the Franco-British exposition is the "flip-flap" shown in this illustration. It consists of two towers or levers, 200 ft. long, which whirl the caged-in passengers through the air in a half-circle. The immense levers are counter-balanced in much the same manner as a lift bridge.



About 8,000 acres of coal lands located in Monterey County, Cal., 200 miles from San Francisco, are about to be developed.

PORTABLE CANNING MACHINE FOR FARMERS

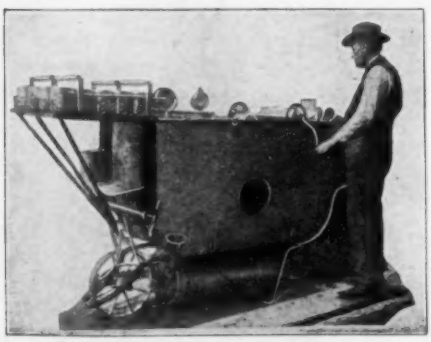
A machine by which the farmer can prepare and can his fruits, tomatoes, corn, beans, or any other farm produce



Top View of Machine

which can be canned, in the fields or orchards in which the vegetable or fruit is growing, has been invented by a Chicago man.

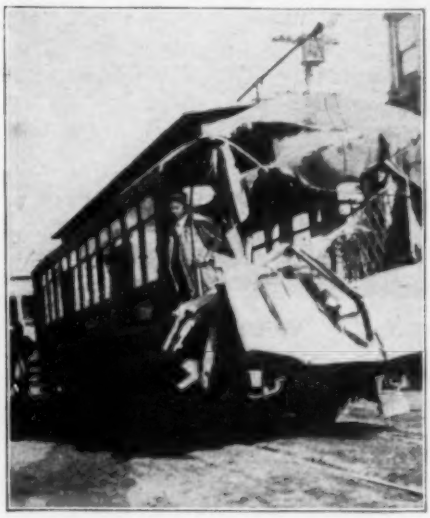
Mounted on a wheelbarrow arrangement the machine can be pushed from one orchard to another or from a tomato patch to a corn field as necessity requires. In operation the cans are first placed in the crate shown at one end of the machine, where they are filled with the fruit or vegetable to be preserved. The crate is then set in water at a temperature of 245° F. and kept there for 10 minutes. The water is heated by a kerosene burner. The heads of the cans are next soldered on, and the cans again submerged in hot water, where they are supported by an endless conveyer which is operated by a chain and sprocket. At the end of an hour this conveyer discharges the cans into a vat of cold water. The hot preserved produce immediately contracts and a partial vacuum is formed. If the can is airtight the top warps inward, which is a sign of the good condition of the matter canned.



Machine is on Wheels

ELECTRIC CAR COLLISION

This photograph shows one of the cars which collided on one of the steep grades in San Francisco. The tracks were slippery and the brakes became locked, shooting the car down hill like a sled on a toboggan slide.



Somewhat Disfigured

RECOVERING BROKEN DRILL FROM 1,000-FT. BORE

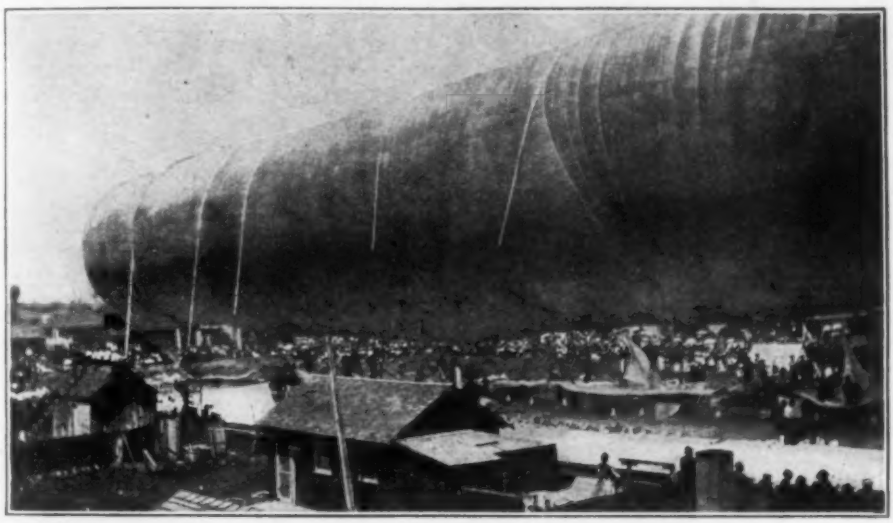
While a bore was being sunk in a German mine, the hardened end of the drill broke off at a depth of about 1,000 ft. A soft bar, 5 ft. long and about 3 in. in diameter, was surrounded with a single winding of wire covered with India rubber. It was then magnetized and let down the hole, and raised the steel to the surface without difficulty.

FALLING WITH A WRECKED AIRSHIP

One of the Passengers Relates His Sensations

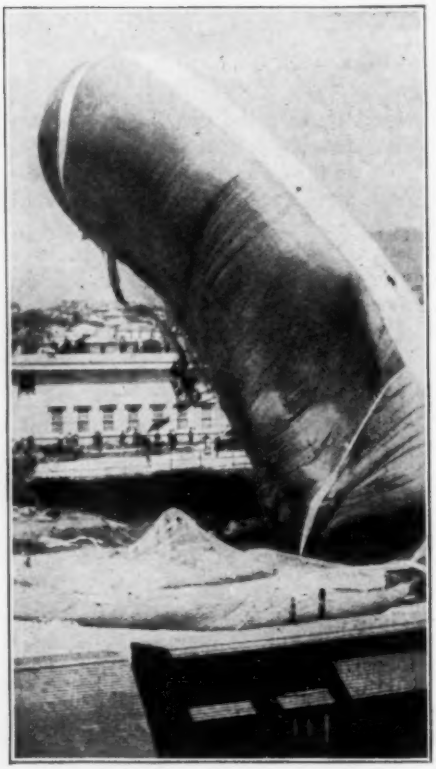
Captain Penfold, the Australian aeronaut who was a stowaway on the Morrell airship when it met with the disaster described in the July issue of this magazine, and who had both legs broken near the ankles as a souvenir of its collapse, has probably made as many balloon ascensions as any aeronaut in the country. During the time the United States "Battle Fleet" was lying off the Golden Gate, and San Francisco was convulsed with the enthusiasm attending its welcome, Captain Penfold made a number of night ascensions in coöperation with the fleet. The idea was to determine if a balloon or airship could get near enough to such a fleet to do serious damage without being discovered, or to land men upon or close beside the ships. The hour at which the aeronaut was to ascend each night was kept from the fleet, but every ship had instructions to watch for him with the searchlights. On two of the nights the searchlights caught him as he was dropping with the parachute, but on one night he dropped into the midst of them without being caught and almost drowned before he was located and rescued from the water.

This was, of course, before the accident to the Morrell airship. He had been an interested watcher of the work of preparing the huge dirigible balloon for the flight on May 23, and had made preparations to be one of the party. On the day of the flight C. A. Morrell, the inventor, tried to dissuade him from going, but when the ship left the ground he was on board. Later, in the Roosevelt hospital at Berkeley, he wrote us a letter describing how he felt when the airship collapsed.



Just Before the Ascent: Only a Little More Than Half the Ship is Shown

"I have made many balloon ascensions to great heights," said Captain Penfold, "and have fallen distances of four and five hundred feet at terrific speed before my parachute opened, so the sensation of falling was not a new one to me. But I always knew the parachute would open and that it would gradually check my fall, dropping me gently when earth was again reached. Were you ever in a position in which you were badly in need of



"The Rear Portion Held Some Gas"

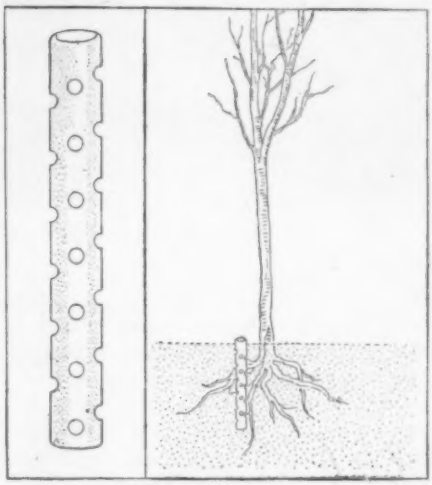
something you usually had with you, but for once in your life was without? If you have ever had such an experience you know just what I was feeling when the gas bag burst above my head and we pitched downward.

"I was near the center of the airship and Mr. Morrell was standing a few feet distant. The ship had risen gracefully and presented a magnificent sight. Not a breath of wind was stirring as we rose to an altitude of 300 ft. While the cheers of thousands came floating up to us the rope near the center of the huge gas bag cut through the covering, and it collapsed. I shot a quick glance at Inventor Morrell and instinctively clutched at my parachute ropes. My hands touched nothing familiar. I was in an airship, not in my balloon. I missed the parachute, missed it horribly, and yet if I had had it, it would not have availed me, as we were too close to the earth for its use. You see, in a balloon of the kind used in spectacular ascensions the only way to get back to earth is to fall, and we prepare for it, but in an airship there is no way to fall but hard.

"The fall was not rapid, or at least, not to me, and the accident might easily have had far more fatal results. The rear portion, as shown in one of the illustrations, held some gas, and the crew near that end escaped practically unhurt. We, in the center and forward end, however, came down hard enough to realize we had reached solid earth again, and I for one, was not sorry after the first shock was over."

TUBE TO SUPPLY AIR TO TREE ROOTS

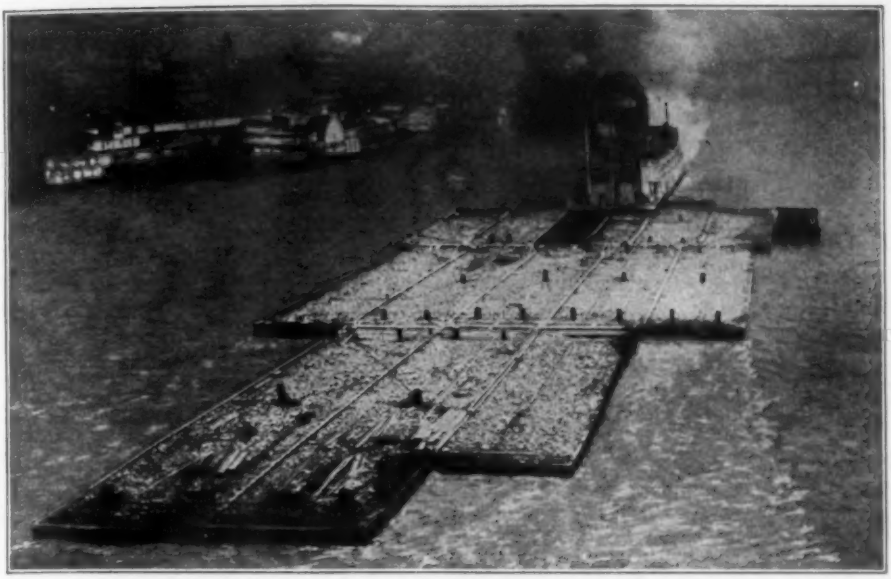
An inventor in Algeria, Africa, has devised and had patented an air tube for supplying air to tree roots. The tube is made of ceramic ware and is almost indestructible. Placed in the ground beside a tree, with the top slightly above the surface to admit the



Air for Tree Roots

air, the young roots find their way through a number of holes. Experiments have proved, so it is claimed, that the growth of vegetation has been greatly advanced by its use.

TOWING COAL ON THE OHIO RIVER



"It Takes 40 Days to Reach the Gulf from Pittsburg"

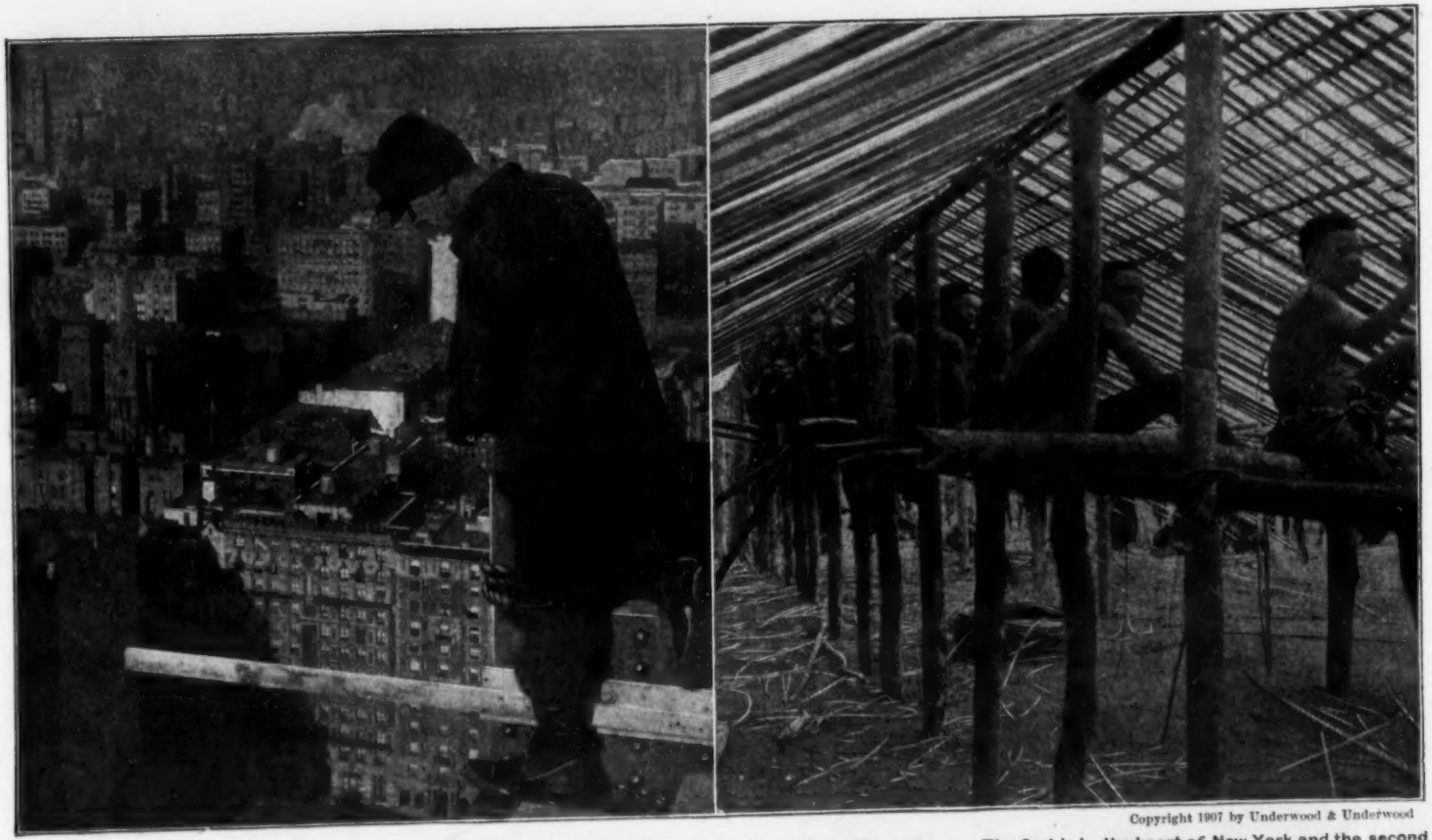
A "tow" of thousands of tons of coal passing down the Ohio river from Pittsburg, Pa., on its way to New Orleans and the Gulf of Mexico, is not an unusual sight, even in this day of neglected waterways. It takes about 40 days to reach the gulf from Pittsburg. Millions of bushels of coal are transported annually by this method.

DANGER SIGNALS IN FRONT OF FIRE STATIONS

Automatic danger signals have been suspended from the span wires of the overhead trolleys of the Denver street railway lines in front of all the downtown fire stations. The signal is so arranged that it lights up automatically when the fire alarm rings in the hose house and burns for 1½ minutes. If the department does not respond to the alarm the signal is immediately turned off by the firemen. When approaching the fire stations the motormen are instructed to note whether or not the danger signal is lighted. If so, the cars must be brought to a stop no nearer than 100 ft. from the same.

CONCRETE CURB AND GUTTER

A number of the streets in Santa Monica, Cal., have concrete curbs and gutters. On this street the gutter is 6 ft. wide. The cost of such construction is probably no more than asphalt with its foundation. The concrete construction is both durable and presents a very neat appearance.



Copyright 1907 by Underwood & Underwood

A greater contrast in building construction would be hard to find than the one shown in these two illustrations. The first is in the heart of New York and the second in the heart of Darkest Africa. In the former a skilled workman is plumbing a steel column from the 31st story of a skyscraper to the pavement nearly 400 ft. below. Men with unsteady nerves do not apply for this work. In the latter a number of Congo natives, just as expert in their line, are putting up a one-story African apartment house.

Courtesy J. T. Bell

At a Nevada Toll Station

STAGE COACHES STILL EXIST

In this illustration is shown the Winnemucca, Nevada, stage coach stopping at a toll station on its trip from Paradise valley. The stage coach is rapidly becoming a relic of the days of Indian massacres.

THE WATER POWER OF THE UNITED STATES

The power of Niagara Falls has been estimated at 7,000,000 hp. A partial estimate places the available water power of the upper Mississippi and tributaries at 2,000,000 hp., and the southern Appalachian district at 3,000,000 hp. Both of these estimates can be greatly increased by including the use of regulation reservoirs and auxiliary steam plants. In the Rocky mountains and the far west there are immense water-power possibilities. All included, it is probable that the water power of the United States exceeds 30,000,000 hp. With the construction of proper reservoirs it is believed that this amount can be increased to 150,000,000 hp.

Using the smaller figure of 30,000,000 hp. as an illustration it is easy to understand what such power means to a country. To develop an equal amount of energy in a steam-electric plant would require the burning of nearly 225,000,000 tons of coal every year, and in the average steam plant, as now existing, more than 600,000,000 tons, or an excess of 50 per cent. over the total coal production of the United States in 1906. At an average price of $3 per ton, it would require an annual consumption of coal costing $1,800,000,000.

The flow of water in many streams annually fluctuates between wide limits. The low-water periods limit the profitable water-power development and the high periods often cause disastrous floods. On most streams the average rate of flow for the year is many times the minimum flow. It is possible in some cases to utilize a flow approximating the average by constructing controlling reservoirs on the headwaters of the stream. The Great Lakes form a natural reservoir of this character for Niagara Falls. The upper Mississippi has great natural reservoirs which assist in regulating its flow, and which easily can be made effective in its control. The floods of the Ohio river can be greatly reduced by the construction of controlling reservoirs on its headwaters, which would result in the saving of millions of dollars now annually wasted by reason of floods.

"Where power is derived from water, winds and tides, only energy otherwise wasted is used," said H. St. Clair Putnam in his address at the conference on the conservation of natural resources recently called by President Roosevelt. "Energy thus extracted is added to the assets of the country instead of being a permanent loss, as is the case when coal is consumed. In the aggregate the available water powers of the country greatly exceed the present power requirements."

During the past few years there has

been renewed interest in water powers on account of the practicability of their use for the generation of power, and the electrical transmission of this power to distant markets. The great hydro-electric development of Niagara was the first large enterprise of this character, and has demonstrated its practicability. The most desirable water powers are being rapidly absorbed, and it becomes important, therefore, for the government to formulate plans for their control and proper utilization.

CASTING CONCRETE PILES

This illustrates the manner in which the concrete piles for the Santa Monica, Cal., ocean pier are cast. Each pile is 14 in. in diameter, with a base 2 ft. in diameter. A 2-in. iron pipe extends

Piles for an Ocean Pier

through each of them, through which water is forced when sinking the pile into position.

EFFECT OF SUN ON STEEL RAILS

In laying street car tracks the rails are often welded together on the surface and then the roadway dug away from under them for the construction

Rails Twisted by Sun's Heat

of asphalt paving. The heat of the sun beating down upon the unprotected rails causes them to so expand, lengthen and twist out of shape, that it is almost impossible to run cars.

HIGHEST CHIMNEY IN THE WORLD

Work on what will be the highest chimney in the world is now in progress at Great Falls, Mont. The giant stack is to be used in connection with an immense smelter plant and will have a height of 506 ft. from base to apex. The foundation, which is shown in this illustration, is octagonal in shape for a height of 25 ft. Above this, the chimney will be circular. The inside

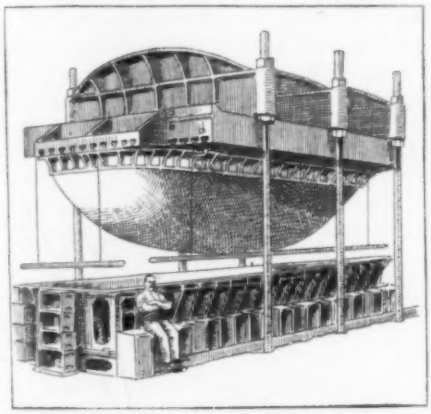
Will Be 506 Ft. High

diameter at the bottom will be 75 ft. and at the top 50 ft. Specially shaped and pressed brick is being used in the construction and the total weight of material will not be less than 16,500 tons. If the chimney were to be constructed of common bricks the number necessary would exceed 5,700,000.

A flue 1,800 ft. long will connect the chimney with the furnaces. Of this length, 1,450 ft. will be 48 ft. wide by 20 ft. high, and the remainder will be 175 ft. wide. This added width is for dust collection. The chimney will cost $50,000.

HYDRAULIC SEAMLESS BOAT PRESS

In many cases the English manufacturers of motor boats are making the hulls of seamless steel. This illustration shows one of the hydraulic seamless boat presses by which this work is accomplished.



Press for Shaping Boat Hulls

TO SOAR LIKE AN EAGLE

Prof. Marcel Deprez, in a paper before the Academy of Sciences in Paris, announced that he has solved the problem of the stationary hovering in the air of a body perfectly free and heavier than air, thus imitating the power of eagles, vultures and other birds able to remain in the air, ascend and descend without beating their wings.

WATCHING AN AUTOMOBILE CLIMBING CONTEST

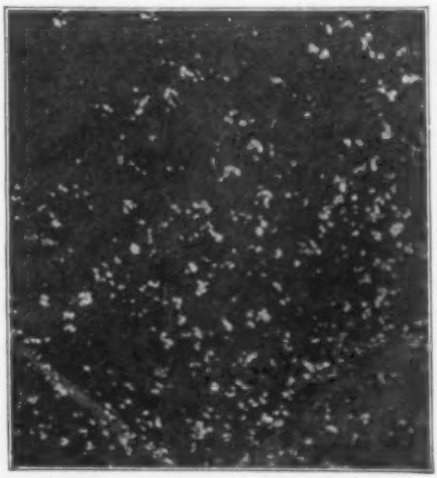
The group shown in this illustration

Automobile Enthusiasts

are automobile enthusiasts, who, rather than miss the details of an automobile hill-climbing contest near Pasadena, Cal., climbed to precarious positions to get a good view of the event. The telegraph pole is 60 ft. high.

LOOKING DOWN FROM THE TOP OF WASHINGTON'S MONUMENT

The accompanying photograph was taken with a camera at the top of Washington's monument. The camera

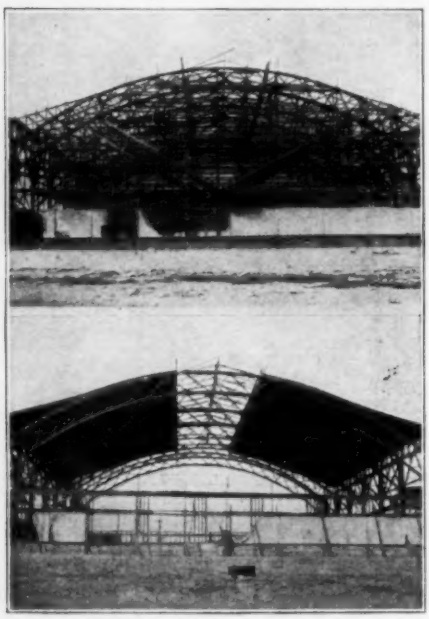


Birdseye View of the Crowds Below

was pointed directly downward when taking the picture and the view contains a group of school children. A walk will be seen which leads toward the White House.

WOODEN SPANS OF GREAT LENGTH

One of the largest wooden-span roofs



Spans Are 116 Ft. Long

in the world was recently completed at Venice, Cal. The spans are 116 ft. long, from base to base, and are constructed of boards 10 in. wide by ¾ in. thick, nailed together to make a rim 6 in. thick. Crosspieces are lattice-worked between upper and lower spans and made fast by 1-in. bolts. One illustration shows the scaffolding first erected, and the other shows the completed arches.

HUGE WARSHIP WITH GAS ENGINES PROJECTED

The British admiralty, having eclipsed the "Dreadnought" class of battleships by the "St. Vincent," which will be launched in 1909, will start in September to build still a larger ship, laying the keel at Portsmouth of a 21,000-ton battleship which will cost $11,250,000. The great feature of this leviathan, if reports are authentic, is the fact that it will be equipped with gas engines instead of steam. Almost as important a feature will be the new 13.5-in. type of guns which have for some time been the subject of experiment. The largest guns in the British fleet at present are 12 in.

The "St. Vincent" is a 19,250-ton ship and cost $6,500,000.

PHOTOGRAPH OF FIREWORKS DISPLAY

The photograph of this display of fireworks at Stamford, Conn., was taken with a 5x7 plate camera by Carleton Bradley. The exposure was 3¼ minutes.

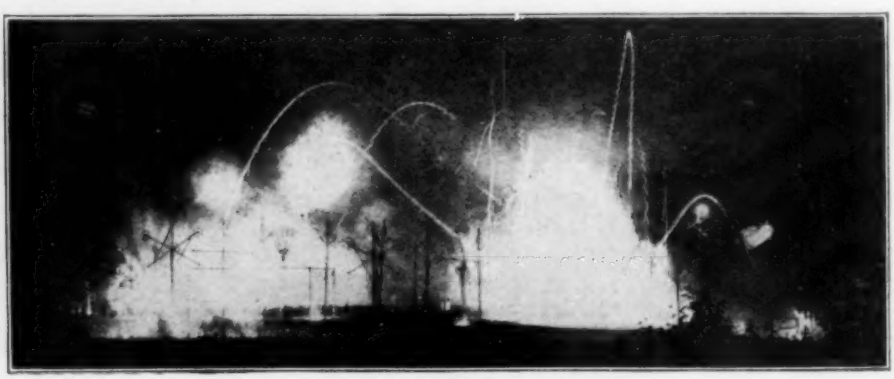


Photo Taken with Light from Fireworks

THE LATEST LUDLOW AEROPLANE

By Israel Ludlow

My new aeroplane has 877½ sq. ft. of surface, divided into 6 horizontal surfaces, each 22½ ft. by 4½ ft., and 12 dihedral surfaces, 4½ ft. by 5 ft. Two of these dihedral planes are rudders. In the rear is a vertical rudder 4 ft. by 5 ft. Patents have been applied for on the general scheme of the arrangement of the dihedral rudders and planes.

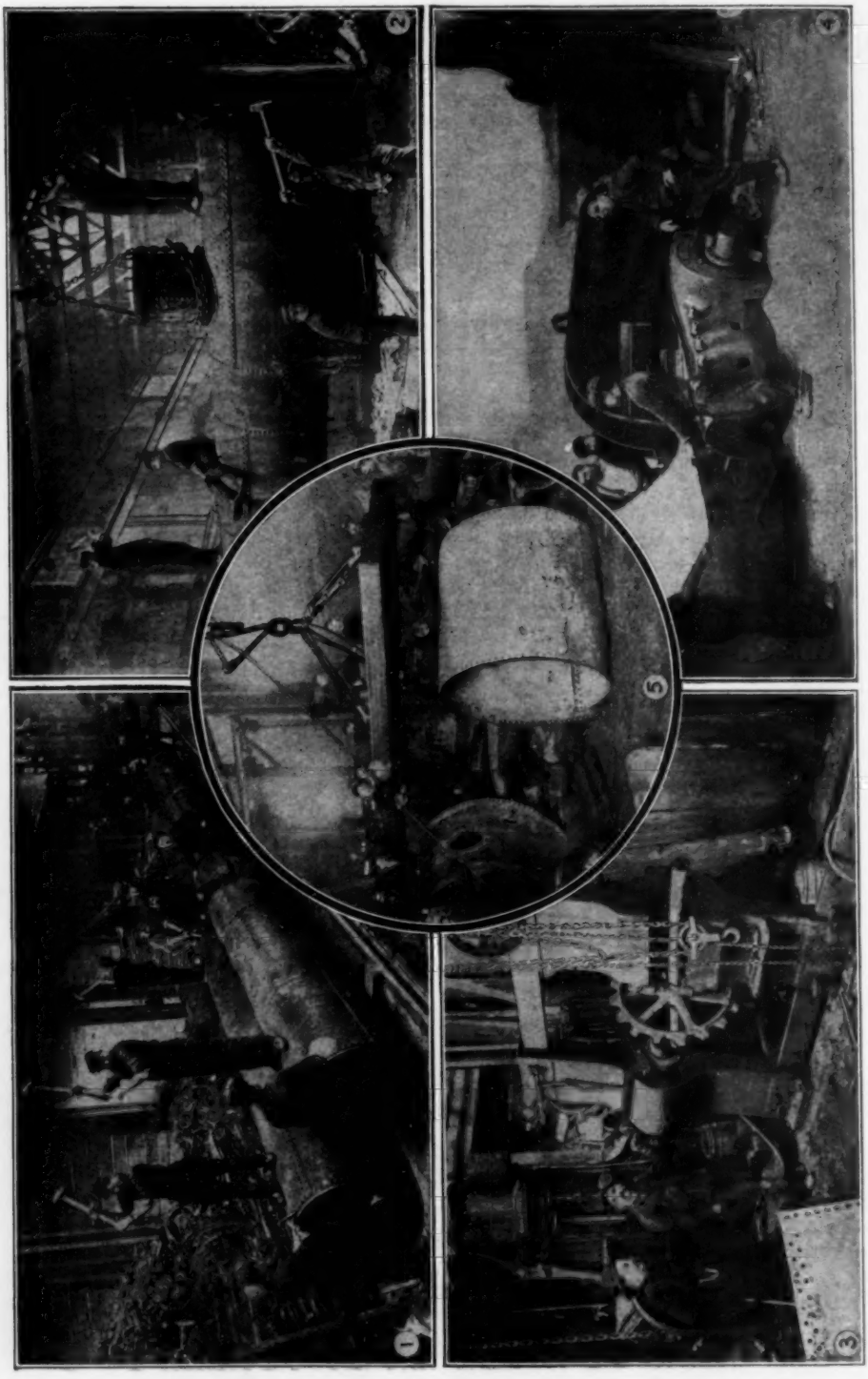
The framework is Japanese bamboo braced by steel wires. The surfaces of the planes are composed of a heavy grade of sheeting, coated with a preparation of paraffin dissolved in gasoline. A single propeller, placed in the front center of the machine to draw it forward, will be mounted direct on the crankshaft of the motor. The machine is made in 6 sections, 5 of which are 22½ ft. long by 4½ ft. high. The sixth section is a triangular frame to run from front to rear, containing the motor. The machine is built to carry two persons and in flight they will stand astride this frame. The total weight, exclusive of the motor and propellers, is 350 lb.

The object of having a series of surfaces with an open space between them is to increase the longitudinal stability, the center of pressure of the whole aeroplane not varying to a much greater extent than the center of pressure of any one of the single surfaces. The dihedral planes insure lateral stability, as it is apparent that in event of a tilt to one side the dihedral planes on the side which is down are more nearly horizontal than the planes on the opposite side, and consequently exert greater upward air pressure, which tends to restore the machine's balance.

The dihedral rudders in the forward set of surfaces are on a lateral axis, and are separately movable at the will of the operator. They will be used to give the initial rise to the machine, to raise one side in the event of a sidewise tip, and to keep the machine on an even keel in turning corners. These rudders afford a simpler, more efficient and a more easily manageable system of control than any twisting or turning effect on the supporting surfaces themselves.

SAFETY VALVE FOR VESUVIUS

An Italian scientist proposes to supply a safety valve for Vesuvius by boring a tunnel in the base of the mountain and letting the lava escape into the sea. His idea is to bore the tunnel while the crater is in a state of coma, and he believes that when the volcano becomes active such a channel would be sufficient to carry away the lava. His whole proposal, however, is not to let the lava escape altogether, but to run it into molds and make it into blocks for use in the streets and quays of Naples. In all probability his scheme will die a natural death.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THE GREAT JUNK INDUSTRY

But few of the thousands of people who see an "old iron" man poking through a heap of rubbish realize that the junk business in this country has grown to stupendous proportions. In Philadelphia last year over $25,000,000 changed hands in dealing in old metal, ranging from the trivial sums paid to the men who search the alleys for small discarded articles, to the many thousands of dollars paid for machinery from dismantled factories.

The Pennsylvania railroad alone disposes of from 10,000 to 20,000 tons of waste material a month to Philadelphia dealers. This is chiefly wornout rolling stock and rails. The company which controls the street railways of that city disposes of almost an equal amount, and hundreds of other industrial concerns add their quota.

One Philadelphia old metal concern, the largest in the world, occupies a plant covering 4 acres, and an additional 27 acres of land on the Delaware river for a dump yard. Two railroads run tracks into its buildings and keep two engines continually busy switching. Such a concern stands ready to buy anything from a complete locomotive to a lot of 1-in. bolts. The material is pretty well sorted before it reaches a concern of this nature, but even then the determination of its final use requires careful judgment.

The machinery of such a concern is both varied in its nature and often ponderous in size. There are shears that will cut through steel plates as if they were paper, heavy steel balls for crushing cast iron, heavy steel slabs for rendering like service to curved metal, machines used for forcing wheels from axles, and numerous other devices. While the work of crushing is going on, the operators get out of range behind practically bomb-proof screens. The scraps fly with almost the speed and force of armor-piercing shells.

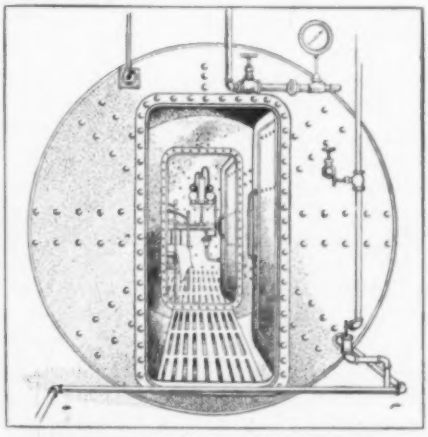
The principal customers of the big junk dealers are the iron foundries, and in such places the discarded metal is melted up and used, according to its composition, to make metal ingots of various kinds and qualities, all of which are in turn manufactured into useful articles of every description.

The illustrations on the opposite page are as follows: No. 1—Wrecking old smokestacks with sledges. No. 2—Demolishing a boiler. No. 3—Forcing wheel from axle. No. 4—Shears that cut steel plates. No. 5—Mashing curved metal.

THE MEDICAL AIR LOCK

The importance of the medical air lock in tunnel construction where compressed air is a factor cannot be overestimated. Workmen, and especially those who have been working back of the shield in an atmosphere considerably compressed, upon leaving the tunnel are occasionally seized with a contraction of the muscles commonly known as "bends." If not treated properly and at once this seizure usually ends in death.

There are six medical locks installed in the East river tunnels, and at least three cases are known in which the men were to all intents and purposes dead, but after being recompressed in them, fully recovered. These locks are fitted

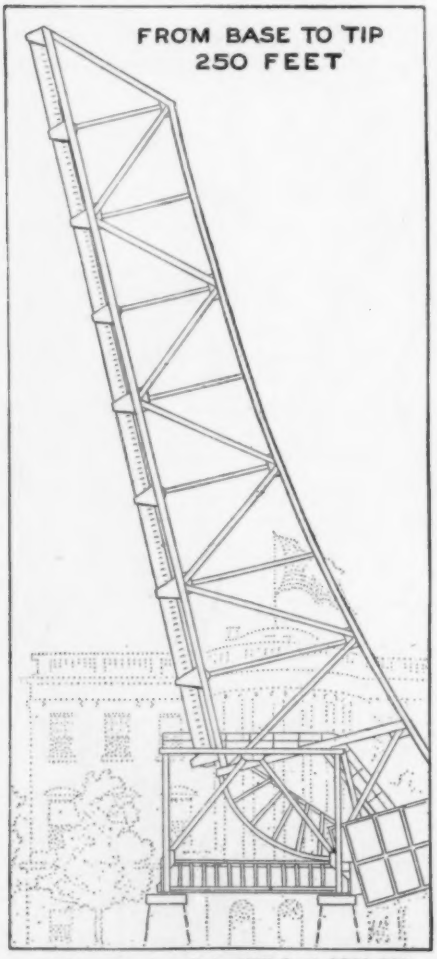


Compressed Air Hospital for Tunnels

up with a double chamber so that the medical officer can pass in and out without interfering with the compression or decompression of the atmosphere. Cots are provided for the patients and the interior is lighted by electricity.

LONGEST SINGLE-SPAN LIFT BRIDGE IN THE WORLD

The longest single-span lift bridge in the world, 250 ft. long and containing 10,000 tons of steel, is now nearing completion in Los Angeles, Cal. Being only 20 ft. wide it will have a toothpick appearance when raised to its great height.



At Los Angeles, Cal.—Will Cost $200,000

The foundation necessary to support the immense weight was secured by sinking three concrete piers in the river bed, and to support these nearly 500 piles were driven. The piers are 60 ft. deep and contain 35,000 cu. yd. of concrete. The track girders, two in number, on which the structure rolls, are 10 ft. high and weigh 65 tons each.

The balance of the bridge will be remarkable for such a huge structure. Two 35-hp. motors will raise and lower it, but should they be put out of commission by accident, one man would be able to raise the structure by pulling on a chain.

When the bridge is down it will lock at the opening end. The locking device will be coupled with signals set about 400 ft. distant from each approach, and should the end of the bridge fail to settle into place, even by the merest fraction of an inch, these signals will show danger.

The illustration gives an excellent idea of its immensity. Its cost will be $200,000.

AERONAUTS TO REGISTER WEATHER CONDITIONS

The United States weather bureau has sent out printed forms to the different aeronautic clubs and weather stations requesting all aeronauts to make use of the instructions they contain.

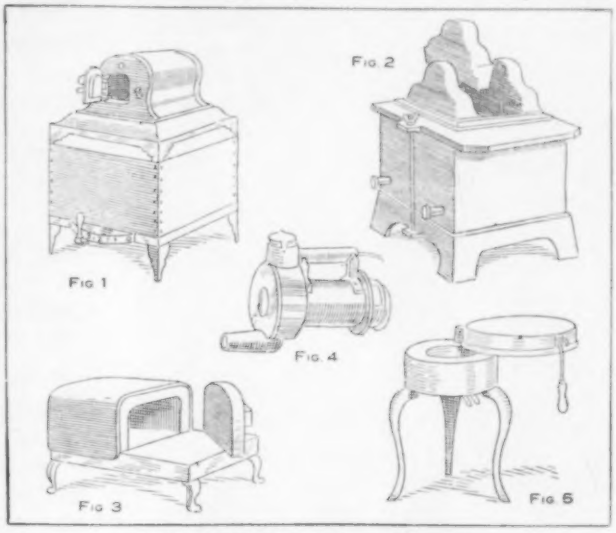
Corresponding with the observations made in the balloon, there should be collected those made simultaneously on the ground. This can be done by arranging with the weather stations for special readings of the bureau instruments during the hours of ascension. Many records in the air have been found of little value because of the lack of joint surface observations. The direction and force of the wind at the surface should be recorded for comparison with the speed of the balloon in its flight. The temperatures within a cloud should be noted, particularly at its upper and lower surfaces. The

time of throwing out sand or using the release valve should also be recorded.

SMALL ELECTRIC FURNACES

It is believed by many concerns manufacturing electrical apparatus that the future of electric heating rests more with its application for industrial than for domestic purposes. The illustrations here shown are examples of electric furnaces for such purposes.

Electric muffles and crucible furnaces are a distinct specialty. Fig. 1 shows a muffle furnace suitable for and largely used by engineers for hardening tools. Crucible furnaces, as shown in Fig. 2, are made to take any size of crucible from 1 in. by 1 in. to 24 in. by 24 in., giving any required heat up to 3,000 degrees F. They are largely used by manufacturing chemists and assayers. As indicating the economy of these furnaces it is said that the type of muffle shown in Fig. 1 will, with a consumption of 200 watts at starting and only 100 watts afterwards, become red hot in 5 minutes.



Electric Heating for Industrial Purposes

An enamelling furnace, largely used by enamellers and painters on glass, is shown in Fig. 3. Fig. 4 illustrates a blower, by means of which cold air can be obtained for ventilation and hot air for warming. Fig. 5 is a tempering, annealing and hardening furnace, suitable for coils of wire, discs and rings of metal.

There are many other such heaters, including vulcanizing stoves, branding tools, soldering appliances and paraffin melting vats for makers of waxpaper and candles.

A light of one candlepower is plainly visible at one mile, and a light of three candlepower at two miles.

SUBMARINE NAVIGATION

Only for the past 10 or 12 years have submarines been seriously considered as engines of war, the first boats of the kind being the Gustave-Zede type in France and the Holland type in the United States. The rapid progress made in their construction and navigation, the future which opens before them and the hopes that are placed on their services have drawn general attention to this branch of naval architecture and raised heated discussions among experts.

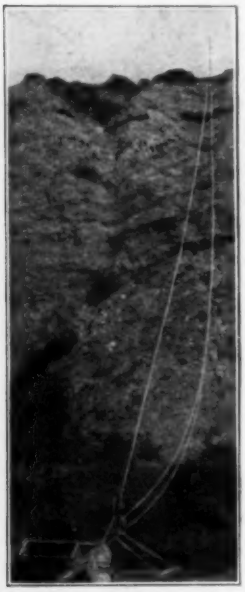
From the very commencement, contrary opinions were freely expressed. Naval men in favor of large battleships have stated that no use would be found for the new type of boat, while the champions of submarine navigation have, for their part, exaggerated to the same degree in the opposite direction, many maintaining that submarines will soon control the seas.

It does appear, however, and seems to have been fully demonstrated, that submarines can effectively defend a coast, prevent bombardment of harbors, render impossible any serious blockading of a port and prevent an enemy's squadron from attempting a

landing. To be efficient, however, the number must be large, as their comparatively low speed makes it necessary that they should form a network around the unit they have to fight.

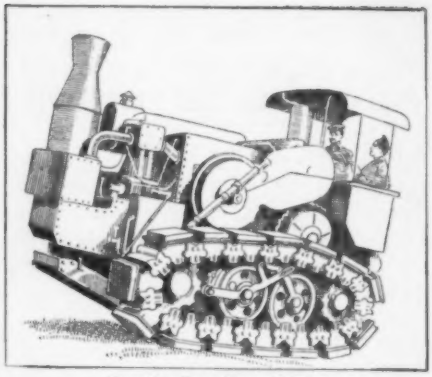
AERIAL CABLEWAYS FOR HAULING FISH

At many places along the Pacific coast, where the rocky bluffs are 300 and 400 ft. high, fishermen have erected inexpensive aerial cableways to transport their catches of fish from the beach to the top. The taut line shown in the illustration is a ½-in. steel cable. On this rests a grooved pulley from which hangs the platform that carries the load. To make the haul easier a light ⅝-in. rope is fastened to a pole at the top of the bluff, run down to the pulley which holds the platform, and back to the top again. A horse, when available, hauls on the line and draws the fish up. Otherwise the fishermen exert their own strength. Such a cableway can be erected for $25. The capacity of the platform in this outfit is 400 lb.



THE CHAIN TRACK TRACTOR

The chain track tractor is essentially an automobile equipped with a number of weight-carrying and sprocket wheels, surrounding which are two endless sprocket chains, one on each side. The inner surface of the chains form a track on which the weight-carrying wheels move. The power is applied to the rear wheels, the sprockets of which engage the inner surface of the links and keep the chains turning. On power being applied, these two wheels, one on a side, pull at a chain, but this being firmly held by the weight of the machine, the effect of the pull is to roll the weight-carrying wheels along the track, and as this is done the feet or sprockets of the chain are carried forward over the sprocket wheels.



For Hauling Heavy Guns

The machine was designed for hauling war material and heavy guns over difficult, trackless country. Swampy, hilly and uneven ground is traversed at an amazing rate of speed for such a cumbersome machine.

RAINY WEATHER GO-CART

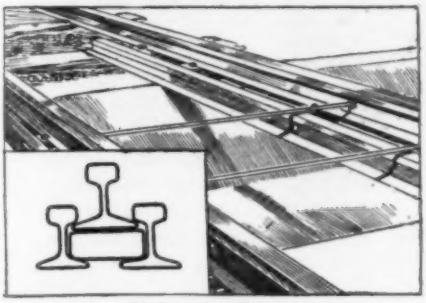
The storm hood on this go-cart protects the little occupant from the heavi-

Storm Hood Keeps the Baby Dry

est rain and in clear weather is packed away in the back. The cart is collapsible and folds into a packet small enough to be placed in a trunk or carried like a suitcase.

CONCRETE AND STEEL RAILROAD CULVERT

The walls are built of concrete and across them are placed two rails, one on

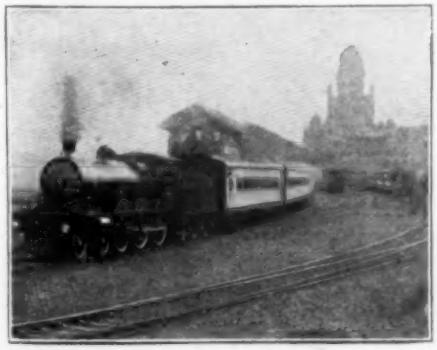


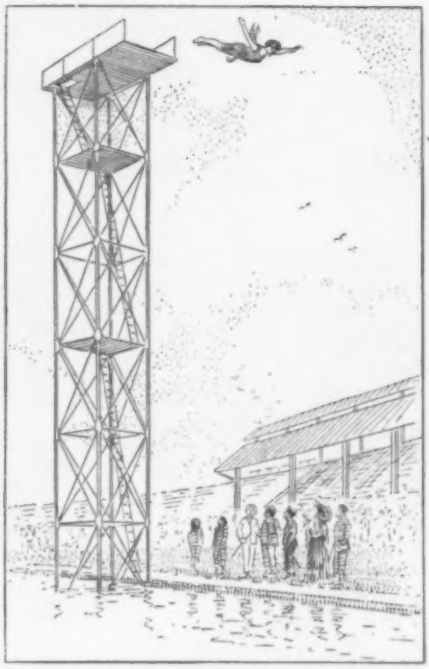
Simple but Strong

each side of the track rails, but 3 in. lower. Cast iron blocks placed below the railroad rails rest on the flanges of the auxiliary rails. The bolts hold all in place. The span of the culvert is 5 ft.

BOMBAY EXPRESS

This illustration shows one of the fast Indian express trains leaving the Bombay station for a trip through the land of tigers and other powerful beasts of the jungle. The railway train in India has to a great extent been accepted by the denizens of the wilds as a fellow monster, and is greatly feared.





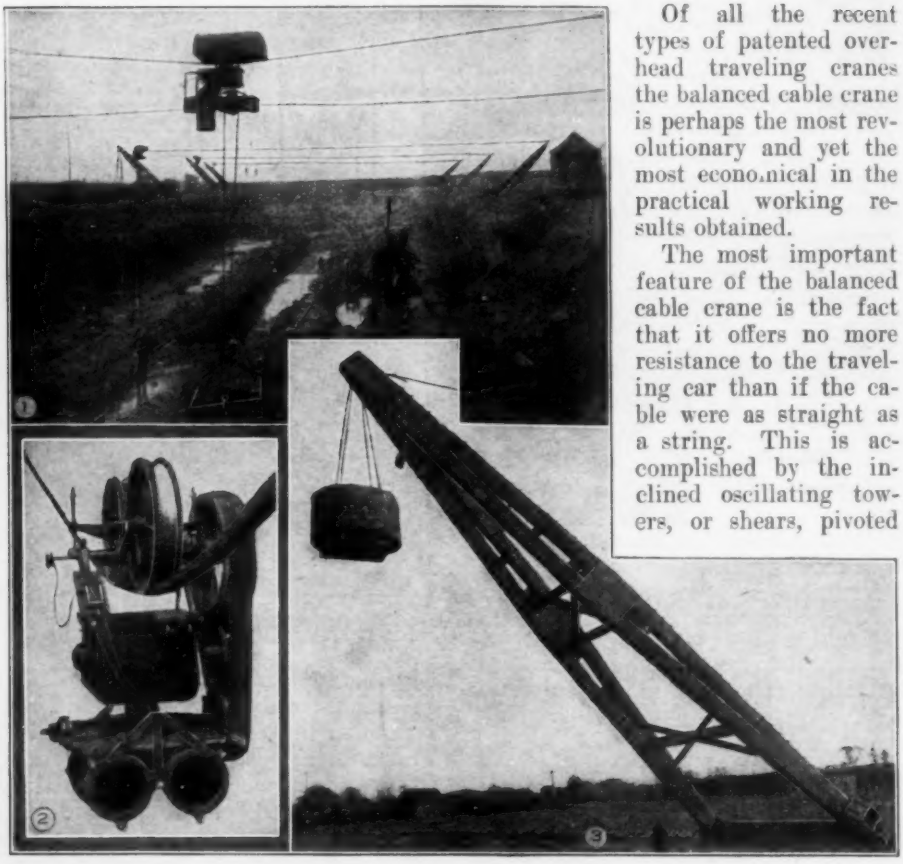
WOMAN DIVES 70 FEET

One of the most remarkable of the exhibitions of diving to be seen in the swimming tank in the Stadium of the Franco-British Exposition is the 70-ft. dive of the champion woman swimmer of Finland. As she gradually turns over in the air and strikes the water head first the spectators draw deep breaths of relief.

ALASKAN COAL FOR NAVY

Overshadowed by the glamor of gold, the discovery of excellent coal in Alaska has been given but little thought by the general public, but the Bering River coal field is destined to be of far-reaching importance in future naval operations on the Pacific. At present American warships are dependent for first-class coal on shipments from Atlantic ports. When it becomes possible to obtain at Controller bay a naval fuel as good as that now mined in West Virginia and Maryland, and in Wales, the movements of our Pacific fleets will be made much easier.

BALANCED ELECTRIC CABLE CRANE



1—Excavating 2—Traveller 3—One of the Shears

Of all the recent types of patented overhead traveling cranes the balanced cable crane is perhaps the most revolutionary and yet the most economical in the practical working results obtained.

The most important feature of the balanced cable crane is the fact that it offers no more resistance to the traveling car than if the cable were as straight as a string. This is accomplished by the inclined oscillating towers, or shears, pivoted at the lower end, and counterbalanced by weights. In other words, the weight of the cable and the car with its load is held in equilibrium by the counterweights. To show how the counterweights entirely eliminate the "dead load" we will start the car from the right side. The counterweights are in their natural position, both touching the ground, and the cable is taut. The weight of the car naturally sags the cable as it runs downward until the center is reached. With the car in this position the oscillating shears have lifted the weights from the ground, but to an equal height at each side. As the car continues along the cable toward the left the shears and counterweights on that end descend, while the opposite shears and weights ascend. Finally, when the loaded car has reached the left-hand shears, the opposite counterweight has receded a maximum, and the cable is again practically horizontal, thus making it unnecessary for the motor of the car to lift the dead weight as the shears are approached.

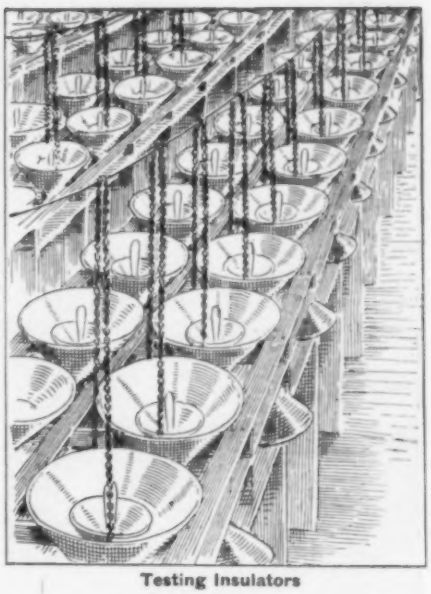
The first illustration shows a view of the Erie cut in Jersey City and part of an installation of six 5-ton balanced cable cranes. The third shows one of the 80-ft. oscillating shears, traveling on a single rail, and a close view of the counterweight. In the lower right-hand leg of the shears is a small box

in which is a 5-hp. motor, sufficiently powerful to move the shears along the track. The second illustration gives a close view of one of the electrically-driven traveling cars.

HIGH TENSION INSULATOR TEST

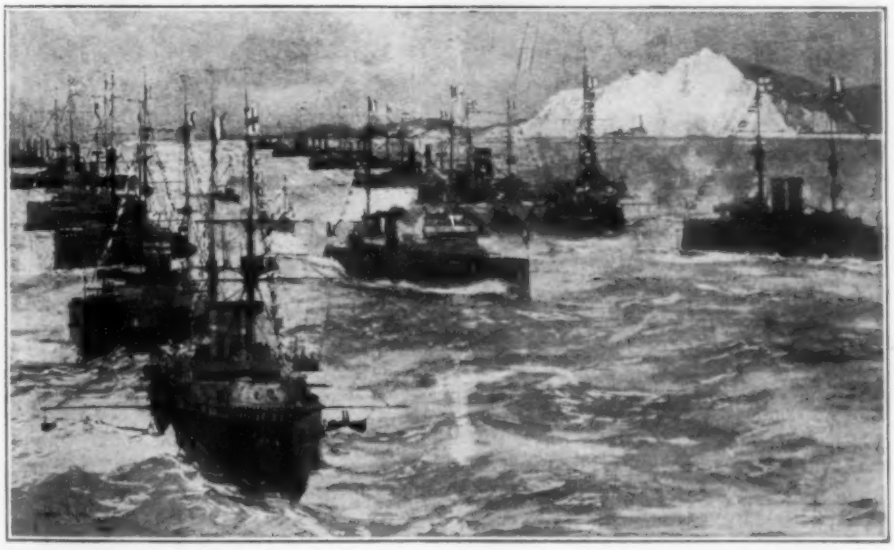
What the limits of long distance transmission will be at the close of the next 10 years is hard to predict. Transmission lines of 60,000 volts and 75,000 volts are now as common as those of 11,000 and 12,000 volts 10 years ago, while transmission lines several hundred miles in length are now being projected and installed for an operating pressure up to 150,000 volts.

That the manufacturers of high potential insulators are meeting the ever-growing requirements of electrical engineers may be noted from the fact that they offer to supply insulators testing from 1,000 to half a million volts. The illustration shows the equipment at Victor, N. Y., of what is said to be the largest single test of high potential insulators in the world. In addition to this testing room there are several hundred other testing terminals at Victor.



Testing Insulators

Old steel rails are used as telegraph poles for a stretch of 30 miles on the Highland Railway in Scotland.



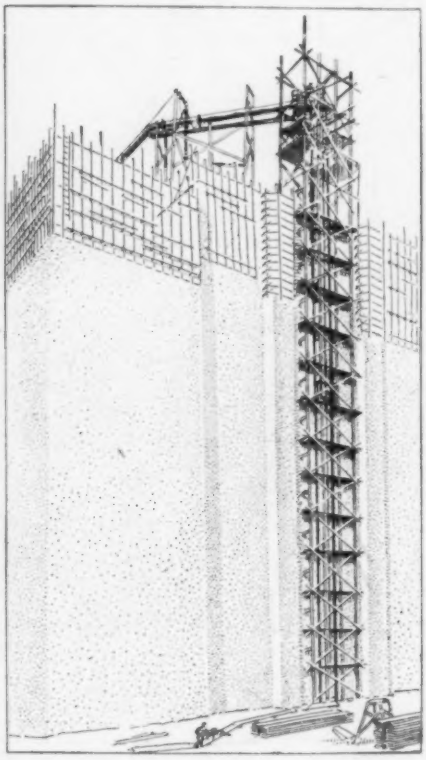
When M. Fallieres, president of the French Republic, arrived at Dover on his trip to attend the opening of the Franco-British Exposition, he was welcomed by the Channel Fleet with a salute of twenty-one guns. The great English war machines lined up in two long rows and the French cruiser "Leon Gambetta," with the president aboard, steamed slowly between them as the bands played the "Marseillaise" and the cannon boomed.

FELLING A HUGE STACK

In rebuilding this immense plant at Trenton, N. J., recently destroyed by fire, it was decided to erect the boiler house in another location and as the huge stack was therefore useless it was felled in almost the same manner as a forest tree. Workmen undermined the south side and a powerful jack was placed under the north base. As this was jacked up the great mass of brick and mortar succumbed to the power of gravitation and swung downward. About midway of the fall the stack broke into three nearly equal sections and crashed to the ground with a sound like the discharge of artillery. Before the dust had cleared away gangs of workmen were busy clearing up the debris. In the concussion of the fall almost every brick was separated from its neighbor so that the heap looked as if it had been dumped from a huge cart. The calculations of its fall were so accurate that it came down in exactly the place prepared for it. Photos by Charles M. Kimble.

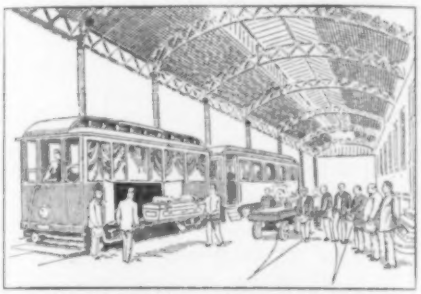
TUBES DEPOSIT CONCRETE IN POSITION

In the construction of a reinforced concrete theatre building in Los Angeles the wet concrete was hoisted to the top of the scaffolding shown in the illustration and then dumped into 8-in. tubes. The concrete flowed through these tubes to the position where it was required, in the same fashion that grain is conveyed from the top of an elevator to the various bins.



SPECIAL RAILWAY FOR ELECTRIC FUNERAL TRAINS

Nearly every metropolitan city in the world has recognized the advantage of utilizing the electric railway systems for the conveying of funeral cor-

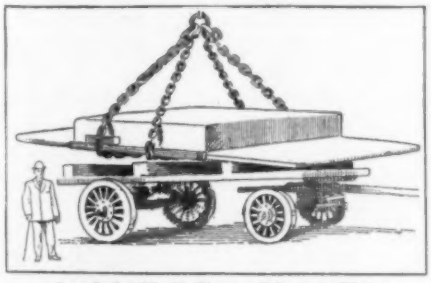


Special Station and Funeral Train

teges to the outlying cemeteries, but in no city has this means of funeral transportation been more developed than in Milan, Italy. In that city the municipal government has constructed a double track electric railway especially for funeral corteges. In this illustration is shown the special station from which the funeral trains start for the cemetery.

HUGE LOAD DRAWN BY TRUCK

In a recent issue a story was published describing the immense armor plate vault for the Carnegie Trust Company. In this illustration is shown

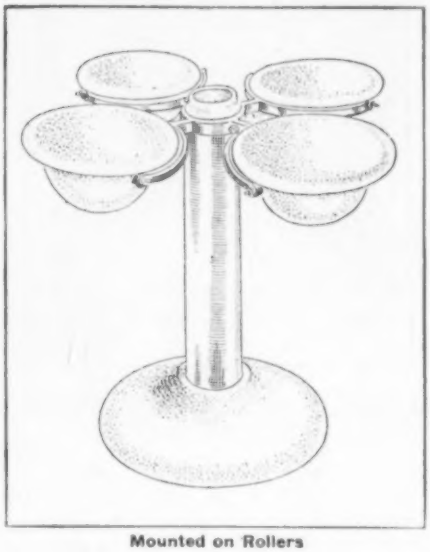


Loaded with 31 Tons of Armor Plate

the specially constructed truck which was used in transporting the sections of the vault to the final destination. The section being lowered onto the truck as the photograph was taken was 30 ft. long by 10 ft. wide and weighed 31 tons.

MULTIPLE BOWL LAVATORY

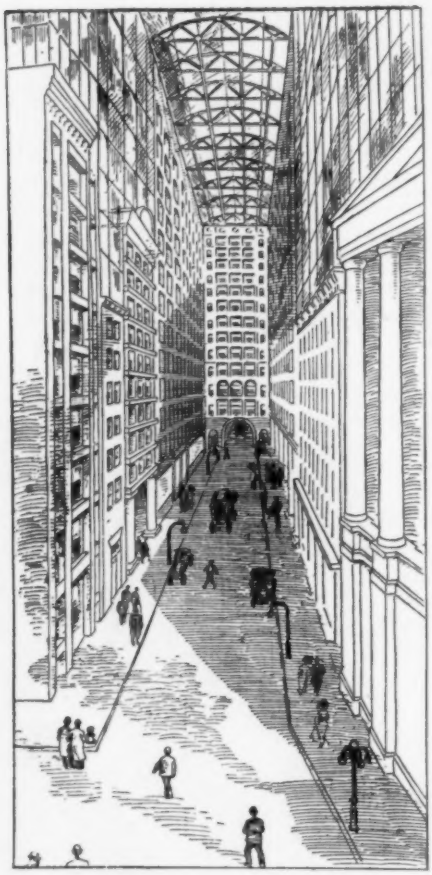
This multiple bowl lavatory is of the pedestal type and is mounted on rollers, permitting its being quickly and easily moved if desired. A white enameled iron base supports a brass nickel-plated column, which carries four semi-spherical bowls, arranged to revolve around a center axis. The bowls are hung on nickel-plated arms with trunions, which permits, with a slight movement, the instant emptying of the contents. Being mounted on rollers it can easily be drawn close to the operating tables in



Mounted on Rollers

hospitals, and such liquids as are required placed in the various bowls, any one of which being instantly available by a slight turning movement. The outfit occupies a space 30 in. square and stands 30 in. high.

The two new battleships which were authorized by the last session of congress will be named "Utah" and "Florida." With the exception of Oklahoma and Wyoming every state in the union is now represented in the navy.



ARCADING NEW YORK'S STREETS SUGGESTED

One of the ideas suggested by the Committee of Thoroughfares, of the New York Municipal Art Society, is the arcading of the streets of New York's financial district, making the whole district practically one vast office building, all under a glass roof.

MANUFACTURING WOOD

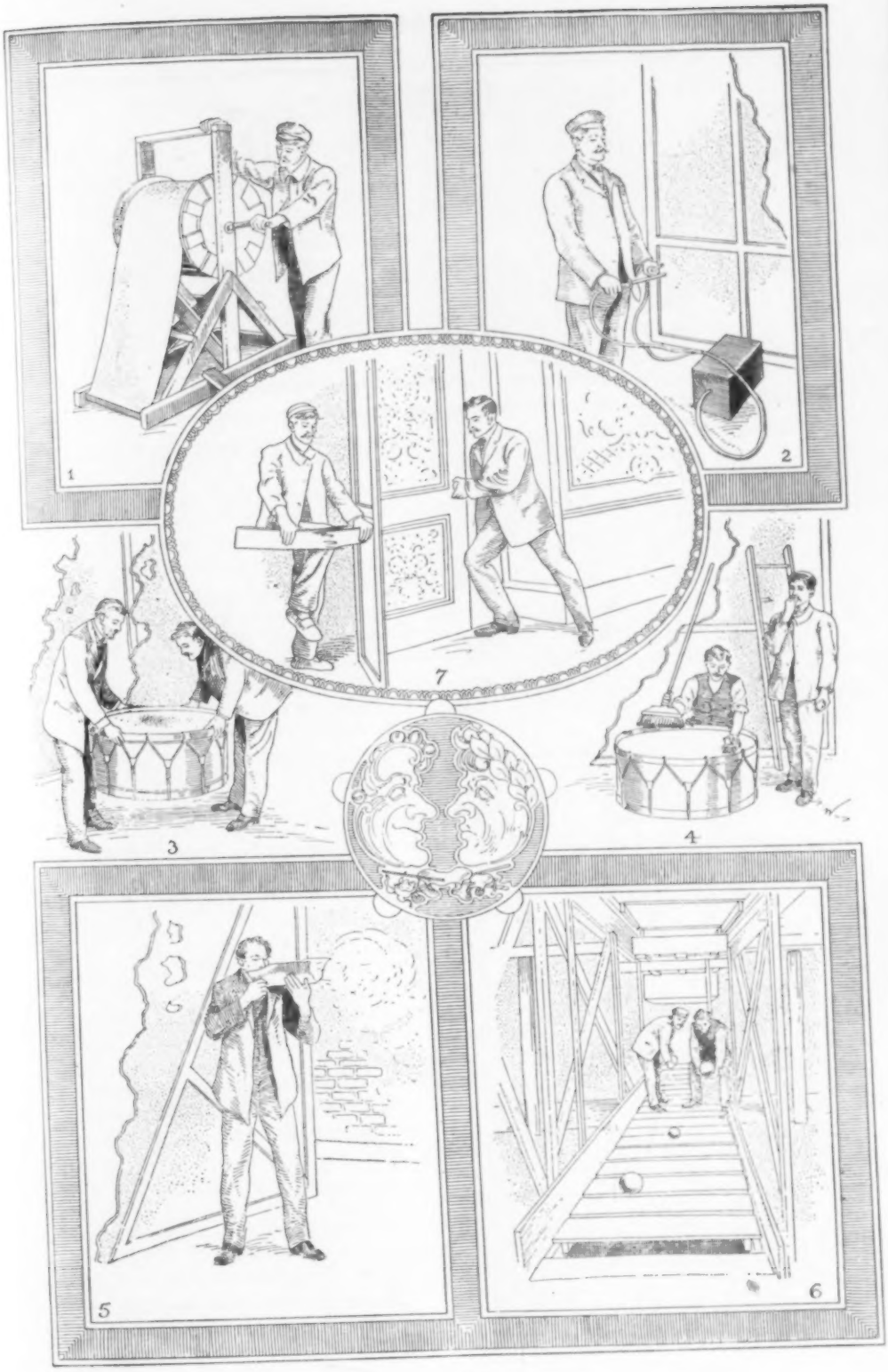
An inventor living in Los Angeles, Cal., is claimed to have perfected a machine that turns sawdust, shavings and chips into solid pieces of wood. The material is carried on a rotary belt from the dump to the machine's hopper, thence into a trough and through this to a plunger or compressor. Through the center of the mold into which the shavings and sawdust are forced is a small hempen rope. A pressure of 20 tons is exerted and the solid body is driven out of the machine in a shape similar to a round stick of wood. The sticks are 4 in. in diameter and are cut in 11-in. lengths.

The machine is claimed to turn out about 6 tons of sticks per day. The inventor is now trying to perfect an improvement by which it will be possible to produce moldings for pictures and wall trimmings.

HOW STAGE SOUNDS AND STORMS ARE MADE

The audience sits enthralled as the heroine faces the wild storm, or the hero risks his life in front of an onrushing train. The scene is as real as life, and in the excitement of the play all forget for the moment that it is not real life, but simply a stage production. The lightning dazzles the eye, the rain almost drowns the music, and the reverberating peals of thunder make the more timid press hands against ears to dull the menacing sound. It looks real and sounds real, but is not real; therefore, at the risk of giving the show away, a glimpse is given of the scene behind the scenes:

No. 1—Raising the wind by revolving a wheel against a cloth. No. 2—The lightning box ready to produce a flash. No. 3—Imitating the pattering of rain by allowing shot to fall on a tightly strung drum. No. 4—Reproducing the noise made by a departing train by rubbing a broom and a hand brush on a drum, while a super imitates the escaping of steam by whistling on his fingers. No. 5—Producing smoke by blowing powder onto the stage from a folded paper. No. 6—Thunder-making with the assistance of iron balls rolled about under the stage. No. 7—Two sides of a scene; breaking open a door. The necessary noise is made by a super, who breaks a board over his knees.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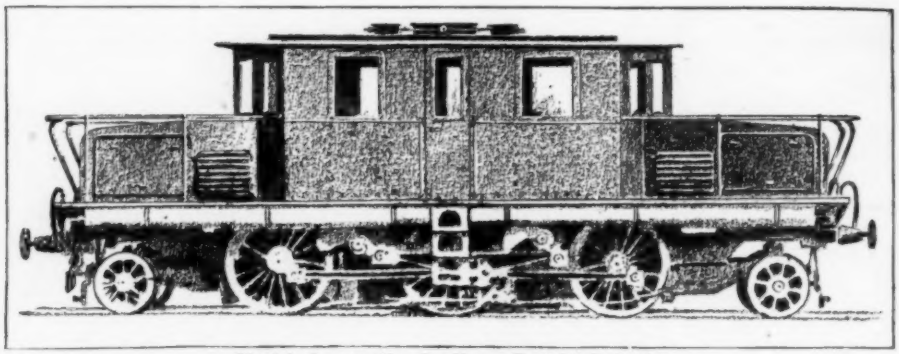
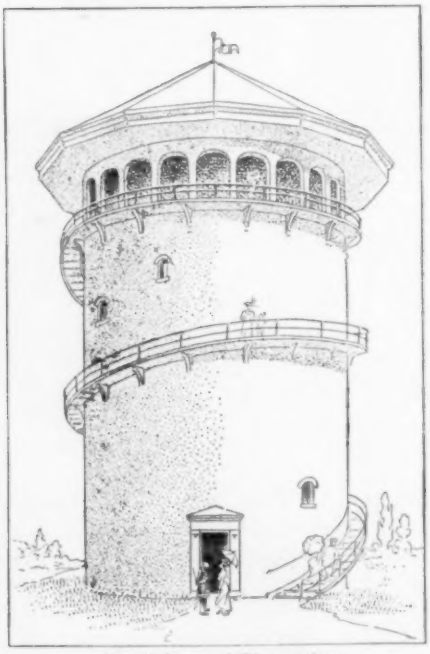


Electric Locomotive for Heavy Freight Switching

STANDPIPE CONVERTED INTO AN OBSERVATORY

A large standpipe in a Seattle, Wash., park has been made to serve two purposes by covering its top with a substantial steel surface and constructing a spiral stairway up its side. It is now possible to obtain a fine view of the surrounding country by climbing to its top, and furthermore the covering safeguards the purity of the water.



Standpipe and Observatory

LARGE SPRINGS IN ARID REGION

The northern end of the valley of Summer Lake, in southern Oregon, contains a group of three or four large springs which unite to form Ana river, the principal feeder of the lake from the south. These springs occur in a semi-arid region, where their volume—about 100,000 gal. a minute—and their constant flow through wet and dry seasons make them objects of unusual interest and a puzzle to investigators.

The temperatures of the Ana river waters indicate that the springs rise from depths 1,000 ft. or more below the surface. The United States geological experts, who have been studying the region, rejected at once the idea that the areas east and south of the springs could furnish the water. North and west of the springs, however, is a mountainous region, not well known geologically, but including an area that is well timbered. It is probable that the surface of this mountain region presents areas of porous rock capable of absorbing the rain waters that fall upon it, forming the source of the waters that issue in such great volume at the springs.

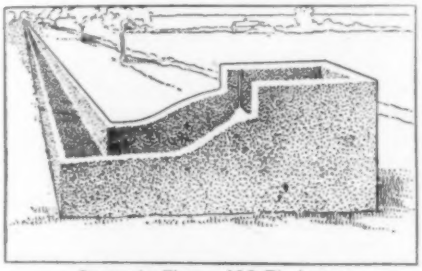
A serious problem for Canada to solve is the fuel supply of the future. No coal of any kind has ever been discovered in Ontario, and in the older parts of the province the timber is practically exhausted.

TWO REMARKABLE AEROPLANE FLIGHTS

Recent reports from abroad state that Delagrange, the French aeronaut, made a flight of 8 miles with his aeroplane in Rome. He remained in the air 15 min. 26 sec. On the same day Henry Farman made a flight of 4,033 ft. in Belgium, with a passenger aboard, thereby winning a bet of $1,200 made with M. Charron, who held that an aeroplane capable of carrying two persons 3,000 ft. would not be constructed within a year.

CONCRETE IRRIGATION FLUME

This concrete irrigation flume, lo-

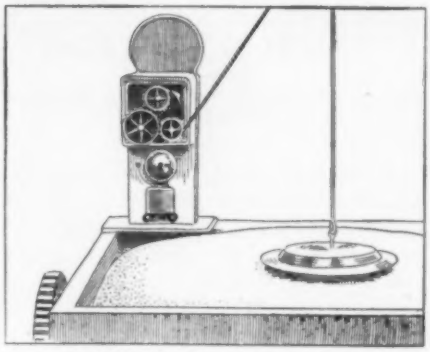


Concrete Flume 406 Ft. Long

cated near Redlands, Cal., is 406 ft. long and 12 in. wide by 12 in. deep. It is fed from the box in the foreground, the height of the weir being adjustable by planks in the grooves.

BREAD-RISING INDICATOR

This device, which is used to automatically notify a baker when his bread has risen, consists of an ordinary battery such as is used for the ringing of door bells, a small tin device which rests on the dough, and a switchboard. In the working of the indicator, the dough rises without giving any alarm, but the moment it begins to fall the gong sounds. As the dough rises the tin rises with it, and the string to which it is attached is wound up on a wheel fastened to the switchboard. After the bread has risen to its greatest height and commences to fall, a cog-



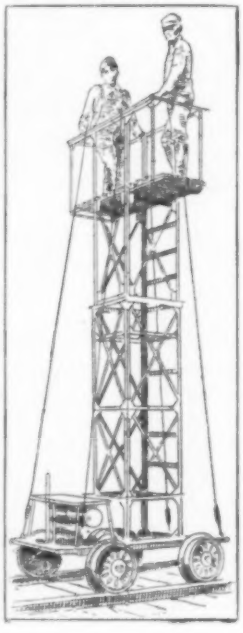
When Dough Falls, Alarm Sounds

wheel establishes the necessary connection with the bell. Provision is made for the announcing of four such risings and falls of the dough.

The device is claimed to work with such satisfaction that a uniformity of bread is possible from day to day.

GASOLINE REPAIR CAR FOR TROLLEY LINES

For repairing overhead construction on electric lines and in tunnels a gasoline repair car of the type shown in this illustration is of great service. The tower is made in sections of angle steel and may be raised and lowered at will, the upper section being telescoped inside of the lower section when the car is traveling over the line.



The power is supplied by a 6-hp., 4-cylinder gasoline engine. The maximum speed ahead is 25 miles an hour.

EDISON'S $1,000-CONCRETE HOUSE TO COST AT LEAST $2,462

Experts Declare the Great Inventor Has Figured Much Too Low

Since Thomas A. Edison announced his plan for the erection of a one-piece concrete house at a cost of $1,000, expert builders have given the scheme much study with a result not at all favorable to Mr. Edison's plans, so far as cost is concerned.

Edison's "$1,000 House"

It is freely admitted by the experts sent out by Cement Age, to which journal the public is indebted for this investigation, that Mr. Edison's work proves conclusively that a house can be built in the way he states, that every practical construction problem involved can be solved, and that a mixture can be obtained which will insure its flowing to all parts of the forms. But the cost?

Edward S. Larned, civil engineer, gives in his article what he believes will be the minimum cost of such a house. Mr. Edison's idea is to construct these buildings upon sandy or gravel areas, furnishing material for the concrete from the necessary excavations. The purpose of this, of course, is obvious in reduction of first cost, providing suitable materials can be found within the limits of the necessary excavation, but this limitation, if imposed, would seriously restrict the development of this class of buildings for the reason that few areas adapted to cheap construction will be found furnishing satisfactory material for concrete, or material in sufficient quantity for construction within the limits of the cellar excavation. The necessity of having good sand and good gravel at once suggests the difficulties experienced in most communities to obtain these materials of suitable quality, and it is fair to presume that in the majority of instances the sand and gravel or crushed stone would have to be brought to the work from sources as near by as possible.

If, as estimated by Mr. Larned, two buildings per month can be constructed from one set of molds, it is apparent that for the greatest economy the molds should be used to their fullest capacity. That at once suggests the time necessarily lost by stormy weather, and in the northern latitudes the disadvantage and expense of attempting such construction during the months of December, January and February.

It will be observed that in the allowance for interest and depreciation given in the table it is assumed that 24 houses could be built per year from one set of molds, and that no allowance has been made for general expense or contingencies. The fixed expense for labor and organization has also been neglected during the time between the pouring of the concrete and the removal of the molds.

ESTIMATED MINIMUM COST OF HOUSE.	
Cellar excavation, 250 cu. yd. at 30c.	$ 75
Concrete, 200 cu. yd., 1-2-3 mixture—	
Cement—206 bbl. at $1.50 (net)	309
Sand—94 cu. yd. at $0.65	61
Stone—156 cu. yd. at $1.50	234
Cost of mixing and placing same at 50c	100
Steel reinforcement, 10,000 lb., at 3c.	300
Forms, erection and taking down, approximately 20,000 sq. ft., 225 tons at $2	450
Transportation (short haul by team) of moulds and plant, including installation of latter	125
Plumbing and heating (reported bid).	175
Windows, doors, and wood trim, including paint	250
Fixtures	50
Total cost, labor and material	$2,129
Moulds and plant, estimated cost $40,000 (Edison).	
Allow 20 per cent interest and depreciation divided among 24 houses	333
Total cost	$2,462

It is at once apparent that the con-

struction of a single house by the method proposed would be prohibitive in cost unless the houses upon completion so commend themselves by reason of their fireproof qualities, low cost of maintenance and practical indestructibility, that they would be in demand rather than cheaper forms of construction.

In this connection it is interesting to note the extent of equipment for railroad transportation. The molds weighing 450,000 lb. would require 10 cars of 22½ tons capacity each; the derricks, boiler and engine and mixing plant would require at least 4 cars more, making a train of 14 cars, which if transported at a fair average rate of $2 per ton would amount to $600.

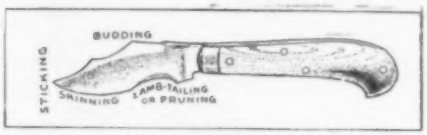
Concerning the table of costs Mr. Edison states that actual construction will show how accurate are the figures given. As to the cost of transportation he says: "Suppose several hundred houses were erected in one place. What would then become of the criticism on cost of transportation?"

ENGLISH SUBURBAN LOCOMOTIVES

The engine shown in this illustration is one of the many types introduced for working suburban and short-distance main line traffic in the metropolitan district of London. One English railroad alone carries an average of 70,000 persons a day between the suburbs and its terminal station.

A KNIFE FOR MANY USES

This knife is al most universally used by the settlers in Australia. The one

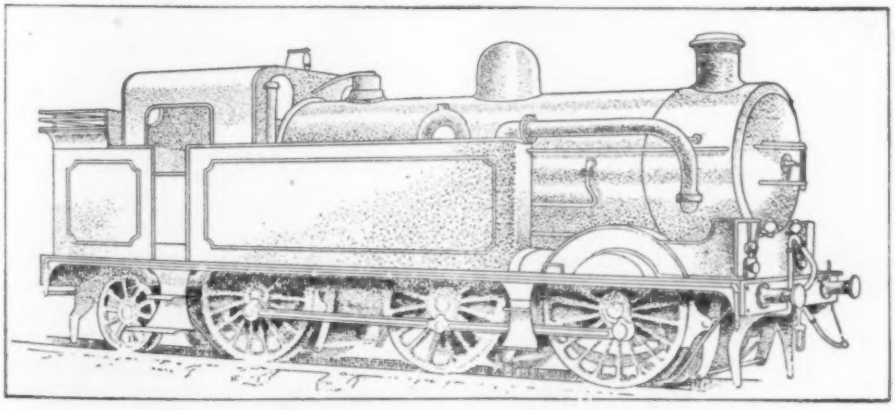


An Australian Convenience

large broad blade of peculiar shape makes it possible to use it for many purposes, among which are sticking, lamb-tailing, skinning, budding and pruning.

BALLOON SPEED RECORDS

The speed records made by balloons today is no greater than that of many years ago, and a flight in 1886 has never since been equalled so far as is officially known. This flight was made by Mrs. Carl Myers, of Frankfort, New York, and she traveled 90 miles in 90 minutes. Her balloon arose to a height of over 4 miles, the highest record in America. In 1859, Prof. John Wise made a balloon journey from St. Louis, Mo., which covered 1,200 miles in length of course, and over 800 miles in an air line, in about 18 hours, or at a rate of about 45 miles an hour.



For London's Suburban and Short-Distance Main Line Traffic

GALVANIZING IRON AND STEEL

Zinc is considered to be the most suitable metal for protecting iron and steel from corrosion, because zinc is electropositive to iron and in the presence of moisture forms a galvanic couple, the zinc dissolving and the iron remaining free from oxidation.

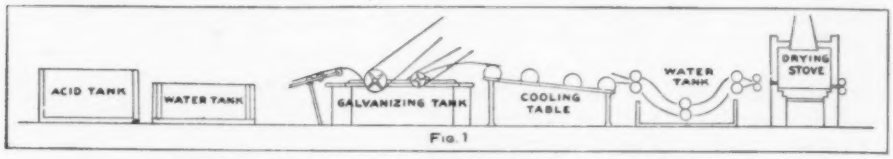


Fig. 1

Continuous Tank for Galvanizing Sheets by the Molten Process

There are now four commercial processes for applying zinc to iron and steel. They are: hot or molten galvanizing, electro or cold galvanizing, sherardizing or dry galvanizing, and cowperizing or vapor galvanizing. Sherardizing and cowperizing are new processes.

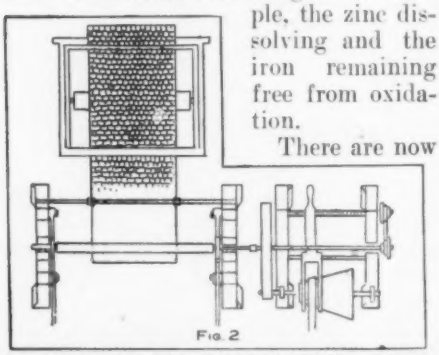


Fig. 2

For Galvanizing Wire Netting by Molten Process

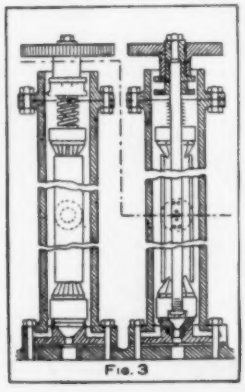


Fig. 3

The hot or molten process was introduced in 1846, and consists of immersing the article, after removal of all scale, oxide and grease, in a bath of molten zinc.

The electrolytic process of coating iron and steel surfaces with zinc has been brought to perfection in recent years. The British Admiralty uses the process extensively for detecting flaws in tubes, forgings, etc., before they are put into actual use. It has also been extensively applied to boiler and economizer tubes for battleships and destroyers.

In sherardizing or dry galvanizing, the iron or steel articles to be rendered non-corrosive, after having their black scale removed, are placed in a closed iron receptacle charged with zinc dust. This can be kept stationary or rotated. The contents of the drum are heated to a temperature of 500 to 600 degrees F. for a time varying from 30 minutes to several hours, according to the nature or section of the iron to be coated.

Cowperizing, or the method of vapor galvanizing, is distinctive from all other processes inasmuch as the articles coated with zinc are not brought into contact with the molten zinc or any of its compounds, but are placed in a separate chamber into which zinc vapor is passed. The apparatus consists of an inner drum composed of wire netting or gauze. In this are placed the articles to be galvanized. The drum is slowly rotated inside an outer cylinder in which the metallic zinc is heated

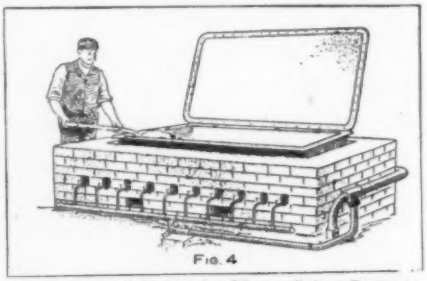


Fig. 4

Furnace for Inlaying by Sherardizing Process

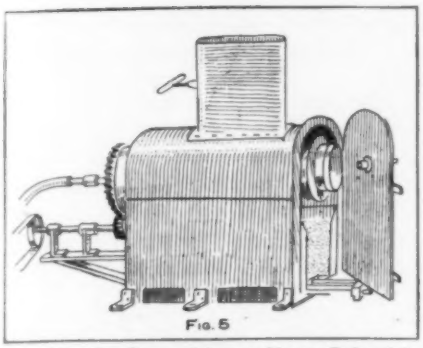


Fig. 5

Apparatus for Cowperizing or Vapor Galvanizing Process

by gas, electricity, or other suitable means, to a temperature sufficiently high to volatilize the zinc. Hydrogen gas is forced into the apparatus and a pilot light of hydrogen is kept burning through a small hole in the door, which makes a gas-tight joint when closed. The beneficial effect of the hydrogen on the color and adhesion of the deposit is probably due to its reducing action. This process has proved successful when applied to decorating porcelain and metallic surfaces with a brilliant coating of metallic zinc.

COTTON ACREAGE IN THE UNITED STATES

The crop reporting board of the bureau of statistics of the department of agriculture finds that the area planted to cotton in the United States this season is 32,081,000 acres. This is an advance of 21,000 acres over 1907. Texas has 9,533,000; Georgia, 4,775,000; Alabama, 3,509,000, and Mississippi, 3,252,000 acres.

THE FRANCO-BRITISH EXPOSITION

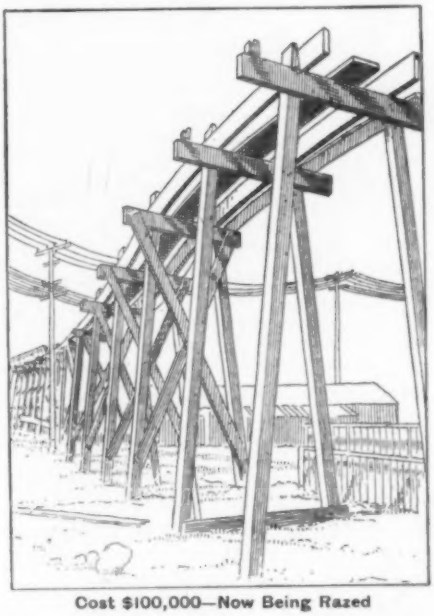
The Franco-British Exposition, which opened at Shepard's-bush, London, on May 14, is the greatest and in many respects the most remarkable exhibition ever held in England, presenting the result of the efforts of two great nations to display to the best advantage their different industries and products.

The exhibits are housed in 20 magnificent palaces and 8 large exhibition halls. The palace of shipbuilding and engineering is the largest in the exposition. The mechanical and scientific exhibits include shipbuilding, constructional and marine engineering, gas, electrical and mining engineering, metallurgy of iron, steel and other metals, transportation, surface transport, and the textile and chemical industries.

The social and recreative side of the exposition is on the same big scale as the industrial exhibits. The stadium, in which the great Olympic games will be held, will seat 70,000 people.

ELEVATED CYCLEWAY IS RAZED

The most remarkable cycleway in the world, and the only one of the kind ever constructed, is being razed to make way for a trolley line. It was an elevated wooden track, 6 ft. wide and in



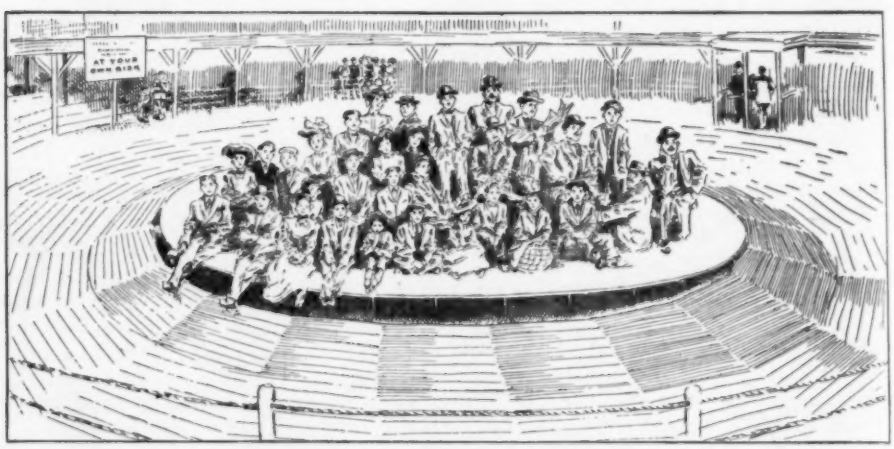
Cost $100,000—Now Being Razed

some places 40 ft. high, connecting, or intended to connect, Pasadena and Los Angeles, Cal. It was built 10 years ago, when the bicycle craze was at its height, was 6 miles long, and had a floor of fine planking guarded by high

rails. Before its completion the bicycle began to lose popularity and the elevated way, to go over which 5 cents toll was charged, was little used. The right of way is now estimated to be worth $500,000, so the Pasadena capitalists whose expenditure of $100,000 has long been a joke in southern California, may realize handsomely on their investment.

HUMAN ROULETTE WHEEL

Of all the pleasure devices that fill a metropolitan amusement park, the latest and, perhaps, most popular, is the human roulette wheel, on which a mass of tangled humanity endeavors to keep its seat, but eventually loses out, like all who tempt fortune on the wheel of chance.



Every One is Whirled Off as the Wheel Revolves

The wheel consists of a rotating platform 18 ft. in diameter, provided with sloping connection with the main floor. As soon as loaded the wheel commences to revolve, and faster and faster whirls, until the human freight cannot maintain its position and is tossed head foremost, feet foremost and sideways down the incline. The roulette finally attains such a high speed that, unless a rider sticks to dead center and allows himself to be spun like a top, it is absolutely impossible to stay on. The tangle of human beings and the comical efforts of individuals to retain their lost seat and win out against the wheel keeps the crowds of spectators in a continuous gale of laughter. Slow speed runs are given exclusively for women, who are certain to be tumbled off, but not with the same abandoned effect.

A GUEST OF HIS OWN HOTEL

Once upon a time, as the fairy story opens, there lived in Connecticut an old hotel man who seems to have been gifted with an insight into human nature to a degree seldom vouchsafed to mundane mortals. He found or surmised that the employes about his place were greatly influenced by his presence, says Hotel World. He could never find them napping; they were ever too quick for him and always on the most alert watch, and yet he felt quite positive that affairs about the hotel did not proceed with the same smoothness, with the definiteness and harmony when he was absent that characterized the place when he was at home.

So he announced a long trip, a journey abroad, proceeded to a barber shop, had his long beard removed and his hair cut short; a tailor completely changed his attire, and other artists were called on to aid further in the

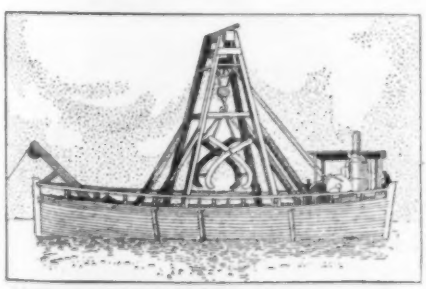
disguise. Then he went back to the hotel, engaged a room, dining daily in the hotel, patronizing every department. He had some trouble in securing the room he wanted, found that he could procure little that was to his liking in the dining room without tipping freely, and in general discovered that the hotel was not what his advertisements proclaimed it to be.

A few weeks' experience as a guest in his own hotel was a revelation. With the head, the ruling power, supposed to be thousands of miles away, the employes from the manager down took on greater license, neglect and indifference.

The successful proprietor of experience will say that there was something radically at fault with the organization in this instance. Yet, if we grant all that, can or will any business stand such a test? Let it be said here, with the greatest emphasis possible, that this test was supreme. When you have your organization in such form as manager that affairs proceed just as satisfactorily when you are away as when you are at home you have made a complete triumph, one of which only a master mind is capable.

FLOATING STONE LIFTER RAISES 50-TON BOULDERS

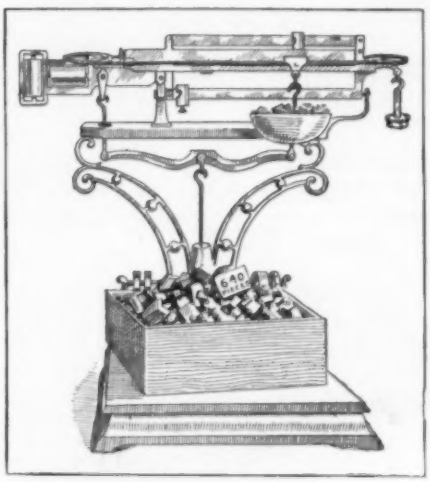
Two remarkable vessels have been placed in commission on the St. Lawrence river ship canal for use in raising boulders too large for a dredge to handle, or to clear the bottom of the river before the dredges commence work. The boat has a 22 by 12-ft. well in the center, through which huge tongs, with a capacity of 60 tons, are dropped to the river bottom to pick up the boulders. A hoisting engine situated aft furnishes the lifting power.



For Raising Boulders

A MACHINE THAT COUNTS BY WEIGHT

This machine is an accurate scale, having, in addition to a regular weighing device, a feature which enables accurate counting through the medium of ratio weighing. With the ratio pan, loaded with small parts, at the extreme left, it is directly over the scale-beam bearings and does not in any way affect direct weighing, whether it is empty or full.



Tells the Exact Number

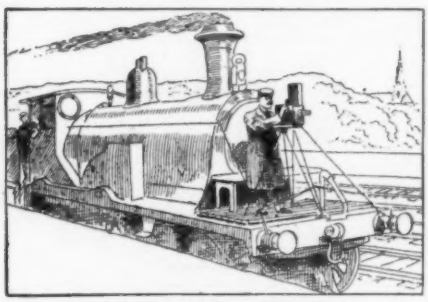
Connecting with this ratio pan is a pointer which is read along a 4-sided beam which is graduated according to the weight of the material to be weighed. In this illustration the side in view is divided with a ratio of 20 to 1, which means that by placing 20 of the pieces to be weighed in the ratio pan and setting the upper beam to 7½ lb., which is the weight of the box or the tare, any number of these pieces placed in the box will be accurately counted by the position of the pointer when the scale balances. In the posi-

tion shown it indicates that there are 640 pieces in the box.

If it is desired to weigh out any special number of pieces, say 500 for instance, it is only necessary to put the number called for on the beam, 20 pieces in the ratio pan, set the pointer at 500, and shovel the articles in the box on the scale. Every manufacturer of small parts is aware of the difficulty as well as the expense of obtaining accurate count, either while the articles are being made, or when they are prepared for sale. This machine seems to solve the problem.

MOVING PICTURE APPARATUS ON ENGINE

The Highland Railway in Scotland runs through a country rich in scenic

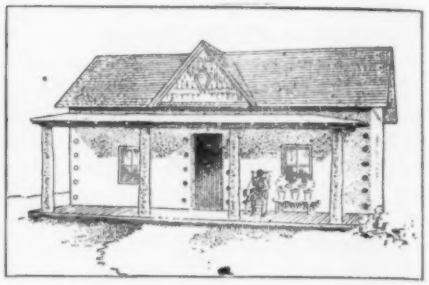


Securing Moving Pictures

attractions. On the front of this Scotch-looking engine with its Scotch engineer was placed a cinematographic apparatus for producing moving picture films as the train rushed along on its journey.

HOUSE OF CEMENT, OYSTER SHELLS AND BOTTLES

One of the most curious dwellings along the Florida coast is near a little settlement called Boynton, and was constructed of cement, oyster shells and bottles by a negro couple who wished a substantial home but could not afford the customary material. The bottles were picked up from junk heaps and the oyster shells gathered along the beach. The bottoms of the bottles were left uncovered at the corners of the walls and around the doorways and windows. The door and porch posts were trunks of palm trees. The floors are of concrete and the roof is shingled.



Queer Construction Materials

The Waldorf-Astoria Hotel in New York and the Bellevue Stratford in Philadelphia have been equipped with wireless telegraph instruments. The stations are on the roofs of the two buildings.

PUSHING A CAR AROUND THE WORLD

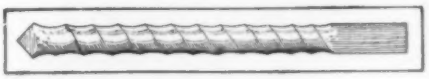
The car shown in this illustration is being pushed around the world by a man who is walking that distance as a constitutional. During the day he pushes the car before him and at night sleeps in it. It is his traveling home and is provided with a bed and cooking apparatus. At present the journey lies through Europe, where his progress is watched by crowds of people.

Takes His Hotel with Him

SHOP NOTES

Home-Made Extension Drill

While drilling some castings one day I found that the twist drill was not long enough to reach through each piece. The holes were to be $\frac{3}{8}$-in. in diameter. I took a piece of $\frac{5}{16}$-in. round tool steel and after heating I hammered it out square and then after taking another heat the square steel was twisted until it had the appearance shown in the accompanying cut.

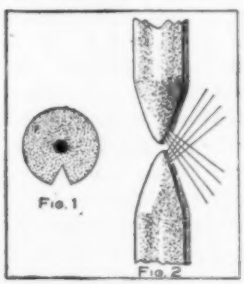


Used Like an Ordinary Twist Drill

After the twisted rod was tempered and ground to the proper cutting edge it was placed in the drill chuck and used the same as an ordinary twist drill. It is surprising how well this tool will work.—Contributed by L. N. Fasnacht, Inland, Ohio.

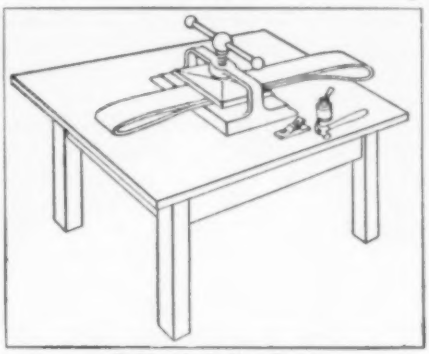
Preparing Carbons for a Moving Picture Machine

For those that cannot secure the side core carbons the following method will help them get a better light: File the carbons so as to make a V-shaped groove in them half-way to the center core, as shown in the cross-section, Fig. 1. When placing the carbons in the machine, set them with the grooves towards the condenser, says the Moving-Picture World. The carbons will burn away faster on the grooved side and will not hide the arc at the crater, as shown in Fig. 2.



Pressure Applied While Gluing Belts

Some means is necessary to apply pressure on freshly glued belting while drying, says the American Miller. The sketch shows the application of an old

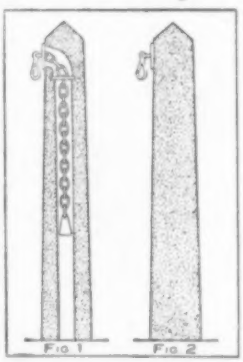


Belting in Letter Press

letter copying press, such as may be found in almost any office, which is very handy for this purpose.

How to Make a Cement Hitching Post

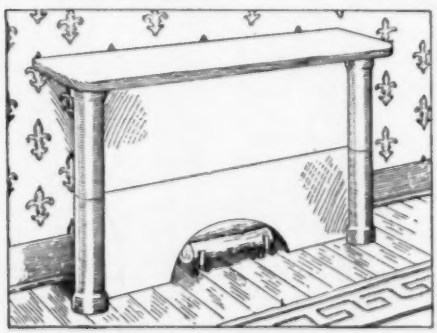
The cement post as illustrated by the accompanying sketch is made in a mold constructed of boards. The shape of the mold can be made to suit the builder. The post should be about 10 in. at the bottom and 6 or 7 in. at the top. When the mold is ready for the cement a 1½-in. gas pipe with an elbow turned on one end is placed in the center of the mold. A cement composed of 2 parts sharp, clean sand and 1 part cement is poured into the mold



around the pipe. When the cement sets the pipe should be in the center of the post, as shown in Fig. 1. A chain with a weight attached to one end and a snap on the other is placed in the pipe as shown. The ring holding the snap is made sufficiently large so it will not pass into the elbow. Figure 2 shows the completed post.

Home-Made Mantel

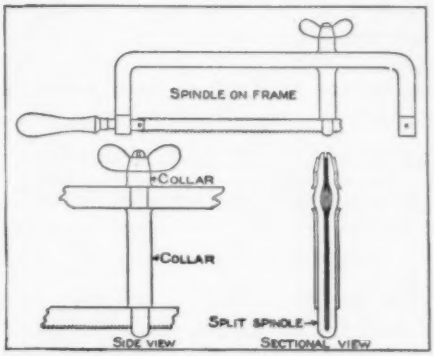
The accompanying sketch shows the construction of a home-made mantel and gas grate. The top is made from a selected piece of 2- by 12-in. plank of suitable length, dressed and finished as smooth as possible, and two of the corners rounded. The columns or supports are made from four lengths of vitrified tile. The smooth ends are placed together with their bell ends apart and then filled with a neat mixture of cement. If care is taken in making the connection the joint will not be seen. These tile columns when placed under and supporting the top board can be finished in any color to suit. The front is covered with sheet metal, and if the metal cannot be obtained in a sheet large enough to cover the whole front, it can be made from two pieces connected with a turned seam in the middle as shown. The bottom part of the metal is cut on a curved line to make an opening behind which the gas logs are placed. This metal front can be finished in colors or bronzes to suit the builder. If it is possible to place the mantel against a wall in which there is a chimney, the burnt gases and fumes can be removed by making a vent into the chimney.



Gas Grate and Mantel

How to Use Broken Hack-Saw Blades

By means of a holder as shown in the sketch it is possible to utilize broken hack-saw blades. The holder consists of a spindle with a slot at its lower end



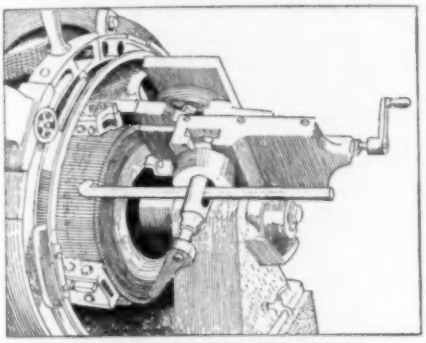
Utilizing Broken Hack-Saws

in which to hold the broken end of the saw blade, says the English Mechanic. This slot extends full length of the spindle and embraces the saw frame at its upper end. Between the blade and the frame is a collar made from a tube cut to the proper length, and above the frame is a shorter collar made from the same material. A nut is screwed on the upper end of the split spindle, and when tightened it binds the broken saw in the slot below the end of the tube and at the same time binds the frame between the top of the tube and the collar. A rigid grip is thus provided, which allows the broken blade to be subjected to tension and held as firmly as when it is complete.

A good quick way for one man to do chalking with a chalk line is to fasten a medium-sized fish hook to one end of the line, after filing off the barb. This can readily be inserted and removed.

Novel Way of Turning a Commutator

The commutator of a small direct-connected generator had to be turned down and a rather novel method was used in accomplishing the work. As the armature could not be put into the lathe without removing the crank disc and the flywheel, it was considered best to bring a part of the lathe to the machine. The compound rest was taken from the lathe and secured to a small



Turning a Commutator

cast plate, about 12 in. long, 6 in. wide and 1 in. thick. The plate was then clamped to the two top studs of the outside main bearing of the generator as shown in the sketch. After removing the brush holder ring and starting the engine, a smooth, even cut was easily taken off the commutator with a stiff boring bar held in the tool post.—Contributed by Elvin F. Brough, Sulphide, Ont.

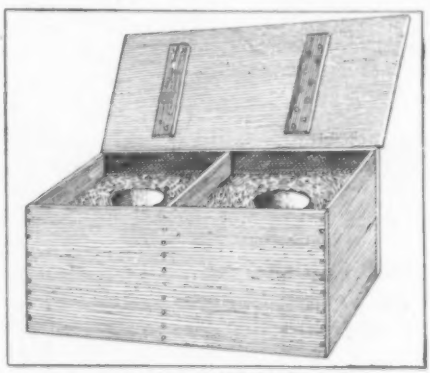
Pullman Body Color

The Pullman body color, which varies in shade from light olive to a dark olive, is commonly composed of drop black, Indian red and medium chrome yellow. Although ivory black and stone ochre is sometimes used in lieu of drop black and chrome yellow, says Railway Master Mechanic, that which contains chrome yellow is preferable, on account of its extra strength, as it will admit of being used much thinner, which is a decided advantage in all colors.

How to Make a Fireless Cooker

During the hot summer months a fireless cooker comes into demand more than any other season of the year, yet the saving of fuel makes this cooking device one of universal favor. To make a two-compartment cooker, as shown in the sketch, purchase two 1-gal. earthenware fruit jars with large mouths which are about 10 in. high and 7 in. in diameter. Make a box 24 in. long, 12 in. wide and 18 in. deep inside measurements, with a tight fitting, hinged cover. A sash lock should be used on the cover to draw it down tight when the cover is closed. The box is lined throughout with heavy strawboard, making lap joints at the corners and tacking it on with 8-oz. tacks. Place a piece of felt weather strip around the top of the inside of the box for the cover to fit against. This will hold the heat within. Fit a board partition in the center of the box, dividing it in the middle and making two nearly square compartments. Place a layer of straw or hay about 4 in. deep and pack down tightly in the bottom of each compartment.

Make two cylinders of strawboard 10 in. high and just large enough in diameter for the jars to fit in snugly. Place one cylinder with a jar in each compartment as near in the center as possible and pack straw or hay tightly around them until the space is filled level with the tops of the cylinders. Two pillows are made from muslin and

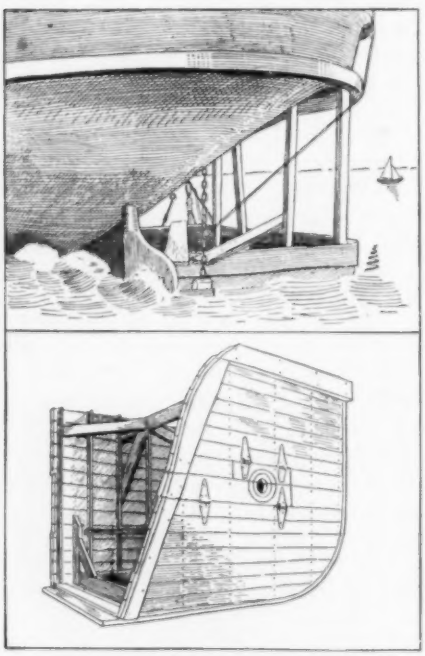


Hay Stove Complete

stuffed with straw so they will be slightly larger than the remaining space above the cylinders. This will allow for a slight compression when the cover is closed. When completed as above the cooker is ready for use. Vegetables, boiled meats, rice and cereals are placed on a fire and heated to the cooking temperature and then placed in the cooker, which continues the cooking until ready to serve.—Contributed by H. M. Roth, Troy, Ohio.

Repairing a Boat's Propeller While in Water

A palace twin-screw steamer broke her propeller blades twice during the season and had to go some distance to a drydock where she could be repaired.



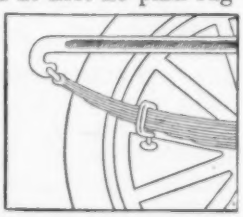
A Repair Cradle for Each Propeller

This, of course, resulted in considerable loss of time, and to avoid any such mishaps in the future, two immense boxes or cradles were constructed, one for each propeller, for repairing purposes. These were sunk into place around the propeller, as shown in the illustration, the shaft of the propeller being inserted in a circular opening in hinged doors on each side of the bearing. The cradle is held in place by braces and the water removed by the steam pumps. When the water is all out the pressure from the exterior holds the cradle tightly against the side of the ship and makes the joint almost watertight. Any water that leaks in is quickly removed with the pumps. In this way the workmen have access to the propellers and can do the necessary repairs in a short time, doing away with the expense and loss of time taking the steamer to drydocks.

The boxes or cradles were constructed as shown in the second illustration. They were made from matched lumber held together with battens made from rail iron. The bearing around the place where the propeller shaft enters the box was made to separate near the center and each half was attached to hinged doors. In this manner the cradles could be quickly placed in position about the propeller blades and the joints made almost watertight.

Temporary Repair for a Broken Automobile Spring

While taking an automobile spin through the country, one of the front springs broke, caused by striking a bump. The spring was of the semi-elliptical type and at first no plan suggested itself as a solution of the problem. In the tool box, however, I found a small hand clamp like those used in clamping the frame of a lace curtain stretcher. The car was jacked up, so that the jack supported the frame but let the spring be relieved of the weight of the car. The clamp was then tightened up on the broken spring as shown in the sketch. This held the broken parts together until a new piece could be supplied. A large monkey wrench could



be used in the same manner and tightened up with a pair of pliers which would serve the same purpose, but the clamp was applied quicker.—Contributed by Paul B. Wright, Cleveland, O.

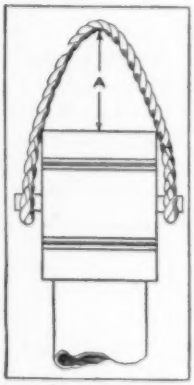
How to Make a Burnisher

An old half-round file will provide the material to construct a burnisher. Grind away all the teeth and round the corners, as shown in the sketch, making the whole surface smooth and then finishing with very fine emery, says the Model Engineer. An extra tine should be ground on the smaller end of the file for the purpose of having a handle on each end. With the aid of this tool a brilliant finish can be given to screw heads, small pins and other similar small work.

Burnisher Made of Old File

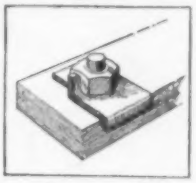
A Quick Repair Bail for Rod Tools

When the bail in the swivel of rod tools breaks, a quick repair can be made by using a rope bail. Take a piece of ¾-in. soft rope about 2 ft. long and splice a close eye in each end; an eye that when finished will require quite a little power to force it over the lugs on the swivel, says a correspondent of The Drill Hole. Enough tucks should be made in the splices so that the distance marked A in the sketch does not exceed 5 or 6 in. Keep the tools hitting on the spring of the cable and you will find that you will have a bail which, in some respects, is superior to the metal one, as it does away with nearly all the noise of the swivel, and owing to the slight spring which it has, is much easier on the ball bearings.



How to Make a Nut Lock

The accompanying sketch shows the construction of a simple lock for a nut. It consists of a piece of ¼-in. sheet metal with a hole punched for the bolt to pass through, and a slit extending part way on one side. After the metal is slipped over the bolt one side is bent down as shown and the nut then screwed up tight, leaving the nut with one flat side parallel with the slit. A hammer and a chisel are all the tools necessary to bring the free end of the slit upright along the side of the nut. Nothing short of a break will allow the nut to turn back. This combination of a nut lock and a washer can be applied in many cases.—Contributed by Donald A. Hampson, Middletown, N. Y.



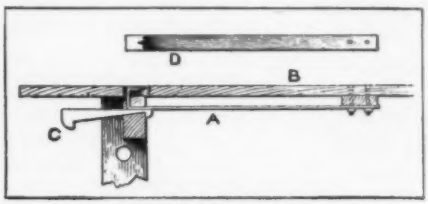
Surface Cleaning Before Varnishing

In cleaning a vehicle body before varnishing it is necessary that every vestige of the pumice should be removed by numerous applications of water, and the use of the water tool, sponge and chamois. Any pumice allowed to remain will become hard there, but the varnish and brush will work it free, to appear all over the work, making it seedy. Not only this, but the brush will get a lot of grit in it, to be parted with some other job, says the Blacksmith and Wheelwright. After the proper washing and rubbing of the job it is well to use a silk cloth to remove any possible lint that may remain from the chamois; for the chamois will have lint. Should any specks appear, after the care taken, remove them with a small bit of wood that is pointed.

PANEL DESIGN—Intended for the middle of a panel on the brickwork of a shop front. The ground to be a light creamy drab, the stencil in gray and brown, and the speckled border a light gray; and outside this a band with deep buff stencil on drab ground, lines of dark gray and brown, and stiles of a deeper drab than the ground of panel.—From the Decorators' and Painters' Magazine.

How to Make a Bench Stop for Woodworkers

The accompanying sketch shows how to make a bench stop that can be instantly adjusted to the work in hand and quickly lowered, leaving a clear bench surface, not in the way of the work on top of the bench when the stop is not needed. A piece of steel is bent in the shape of a hook, A, and made square at the turns and fastened to the under side of the bench top, B, with two bolts. The two bolts pass through the bench top, through a small block of wood and through the end of the piece of steel which now forms the bench stop. The holes through the bench top should be countersunk to admit the heads of the bolts below the surface, says the Blacksmith and Wheelwright. A key, C, is shaped as shown and used for making the adjustments.

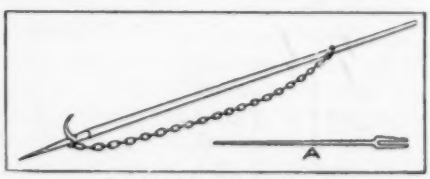


Details of Bench Stop

By simply pushing the key to the right the stop is raised to any desired height. In this case a recess is cut in the cross-piece to support the key. If the stop is located away from the cross-piece, simply make a bolt to support the key. The top of the stop is shown at D, which is filed with a V-shaped notch in the center and teeth cut on each side. A spring leaf can be used to make the stop. The hole for the vise screw is for a carpenter's bench where the vise does not come above the bench.

Tool for Work on Mill Dams

Illustrated herewith is a tool that is handy for making the work easier when piling planks from sluices on mill dams when the water is high or in the spring time during freshets, says the American Miller. It consists of a common boat-hook with a chain attached. The chain should be as light as possi-



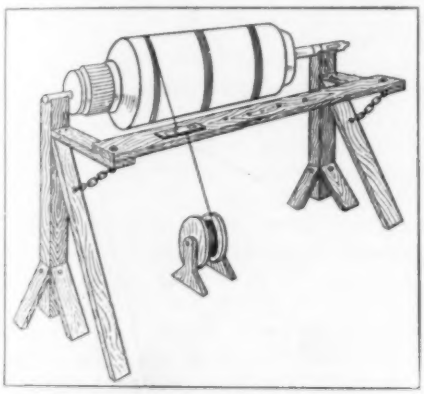
For Work on Mill Dams

ble, but strong enough to stand the strain it will receive. About a 5-16 in. chain will do.

The slack in the chain is taken up by sliding a large link on the end of the chain up on the pole. The pole may be of any length desired. The bar A has a crab-claw to catch into the links of the chain and bear on the fulcrum under bar when using.

How to Band Armatures

Small roads having few cars cannot afford expensive equipment in their repair shops. A master mechanic and correspondent of Electric Railway Review has supplied a device for banding armatures without using a lathe. The



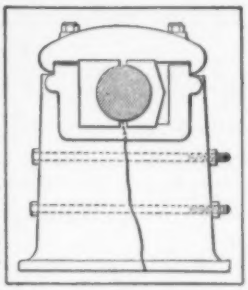
Banding Armatures Without a Lathe

armature rests, as shown in the sketch, on two special stands. Connecting with these stands and running alongside the armature is a 2 by 4-in. hardwood tension bar on which, by means of lag screws, fiber tension blocks can be placed to guide and put a tension on the banding wire taken from a reel standing on the floor below. A special crank is arranged to fit the pinion end of the shaft so that the armature may be turned while placing the band wire.

Stove pipes, boiler tubes, etc., may be kept clean from soot by throwing a small piece of zinc into the fire occasionally.

Repairing a Cracked Main Bearing

A large cross-compound engine that had to run 20 out of 24 hours was running as usual when the low-pressure crank broke and came around, striking the end of the connecting-rod, which broke the main bearing and pushed the shaft about 6 in. ahead of the engine; also breaking the piston rings.



The engine was shut down and repairs began immediately, says a correspondent of Power. Two holes were drilled through the bearing and two bolts 2 in. in diameter were put through, as shown in the sketch, and drawn tight. The low pressure side was put out of commission and the engine started on the high pressure side, which ran satisfactorily until a new crank could be forged.

Depositing Copper on Glass

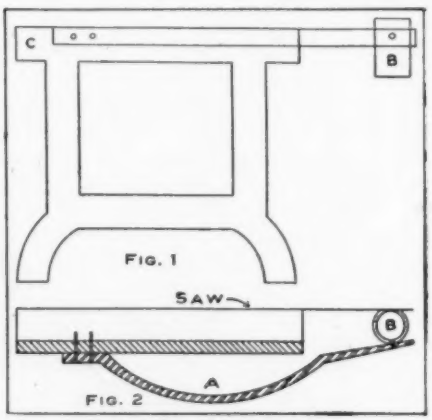
A new method of depositing copper on glass has recently been discovered by an English investigator, says the Brass World. A mixture of 1 part of freshly distilled phenyl hydrazine and 2 parts of water is heated until the solution is clear. A warm solution of cupric hydroxide in ammonia is then added (made by precipitating sulphate of copper by potash, washing and dissolving in ammonia). The cupric hydroxide is reduced to cuprous hydroxide with evolution of nitrogen gas.

A hot 10 per cent solution of caustic potash is then added until a slight precipitate of cuprous hydroxide takes place. If the solution, in this condition, is brought in contact with a clean glass surface, a bright deposit of copper forms on it. This is thin and perfectly reflecting.

The copper thus deposited is washed after an hour or so with water, then with alcohol, and finally with ether, in order to dry it without rupture. It is then coated with lacquer or varnish.

An Oiler for Automatic Saw Grinders

Perfect grinding of saws can be done on any automatic grinder, providing the saw is kept in the right shape and



Details of Oiling Device

is properly prepared for grinding. The saw should be cleaned and oiled after it is placed on the grinder. This can be accomplished by taking cotton waste saturated with kerosene oil and applying it to the saw inside and out, where the clamp comes onto the saw. If the saw is not oiled, it will get gummy and when in this condition imperfect grinding will be the result, says the Wood-Worker. This cleaning can be done with the machine itself, by attaching an oiling device, as shown in Figs. 1 and 2.

The device can be made in a short time. Get a piece of old band saw steel, any thickness from 16 to 18-gauge, and cut a strip about ¾ in. wide and 12 or 14 in. long. File the edges nice and smooth and bend it as shown at A, Fig. 2. Punch two holes in the end where the spring is fastened to the clamp, and one hole at the other end, to fasten the stuffing box with a stove bolt.

The stuffing box, B, can be made by taking a piece of brass pipe 1½ in. in diameter and ¾ in. longer than the saw clamp is wide. Put a wooden plug in the bottom of the box and file a slot in the side where it comes in contact with the saw. This will leave it in such shape that if the waste is stuffed in tightly it cannot fall out, and at the same time it can be forced outside the box, so the waste will have a bearing on the saw only. Fasten the box to the spring with a stove bolt and fasten the spring with wood screws to the grinder clamp, C.

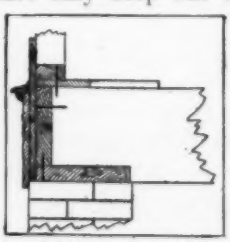
By the use of this device all that is necessary to do is to saturate the waste about once a day, and the rest of the work is done by the grinder. The same device can be put on the inside of the grinder also, by the use of a different spring to suit the angle.

Home-Made Linoleum

A good strong linoleum may be made from old Brussels carpet that has not been worn through. Tack the carpet, right side down, on the floor, and then apply paint, giving it a large number of coats; the last few coats to be of the desired color, allowing each coat to dry well. If the paint begins to wear, apply a fresh coat of paint. The effect of mosaic tile may be produced by dotting the last coat with different colors of paint.

A Rat-Proof Sill Construction

The accompanying sketch shows in detail how to construct a sill that will not only keep out the rats and mice,



but has the advantage of making a solid backing for the baseboard. A 2 by 12-in. plank is placed flatwise on the foundation to which is first spiked a 2 by 10-in. plank at right angles on its outer edge. By making a 2-in. mortise in

the joist to fit over the 2 by 12-in. base, the top edge of the joist will be level with the 2 by 10-in. plank, says the American Carpenter and Builder. A rough flooring is now laid, on top of which is placed a 2 by 4-in. stud, flatwise and flush with the outside of the construction. This makes a solid backing for the baseboard. On this 2 by 4-in. stud is toe-nailed the upright studding forming the sides of the building.

Home-Made Trammel Points

Having had occasion to use trammel points when there was none at hand, I

set about to make them, says a correspondent of Power. I took two old worn-out files and broke them off within ½ in. of the tine. I next had them annealed and ground off the teeth, drilled a ¼-in. hole, as shown in the sketch, and $\frac{3}{16}$-in. tap holes for the thumb screws. Then by using a ¼-in. polished rod flattened on one side to hold the points, I had trammel points that were useful in many ways.

How to Recut Threads on Small Machine Screws

It is often necessary to cut or rechase threads on small screws and in doing so, if the screwhead is placed in a vise it is almost sure to spoil the screw. Change the operation by placing the diestock in the vise and running the screw through the die with a screwdriver. This will always save the finished screwhead.

Show windows may be cleaned by using the following paste, applying with a soft rag and rubbing off with another soft dry rag: Mix thoroughly together 9 oz. prepared chalk, ½ oz. white bole, ½ oz. jeweler's rouge, 5 oz. water and 3 oz. alcohol.

Striking the Water Line on a Boat

(Condensed from an Article by C. G. Davis, in Motor Boat.)

Painting the water line of a boat is not so simple a matter as some people suppose it to be. Many are somewhat surprised to find that the bottom paint is considerably higher on one side than

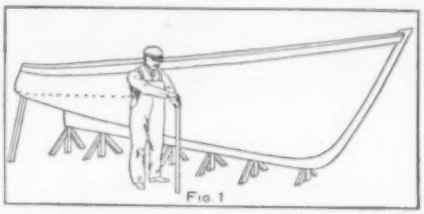


FIG. 1

on the other after they get the boat afloat, making the boat appear to be resting crooked on the water. A new boat built in a shop with a smooth level board floor under it, can easily have a water line scribed around it by cutting a stick the exact distance from her proposed water line to the floor and then, holding this stick vertical, going around the hull making a series of spots every few inches apart as shown in Fig. 1.

To strike a new line on an old boat the first thing to be done is to drop a plumb-bob from the point of the stem and off the center of the stern and see if the boat is standing perfectly plumb, as shown in Fig. 2. If it is, you are ready to begin, but if not, wedge up and down on the shores or blocking until you get her perfectly true, as the plumb-bob will show.

Secure two long boards, at least twice the width of the boat, that have been planed up so that they are straight on one edge. Nail the middle of one of these boards so that its straight edge comes just level with where you want the water line to be. Hold the ends up by nailing two posts to the floor and put two braces aft so that as you pull from one to the other to tighten the line they will not move. Tack the other board fast aft, the same way, being careful to have the two perfectly leveled up with a spirit level. With a

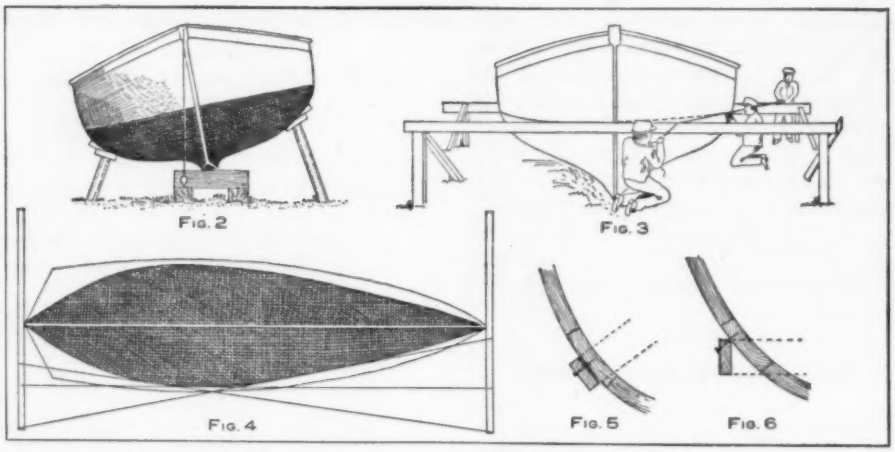


FIG. 2

FIG. 3

FIG. 4

FIG. 5

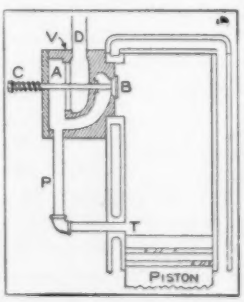
FIG. 6

fish line made fast at one end—or quicker yet, let another man hold it—you can swing this line out on one board and in on the other so that a third man with a pencil can make a series of spots around the hull that will guide you in getting a perfect water line, as shown in Fig. 3. In Fig. 4 is shown the method of swinging the line to get the different angles of the boat. By bending a thin batten the line can be scratched in through the spots made on the boat. To do the work properly procure a batten about 1 in. wide and less than $\frac{1}{4}$ in. thick and a handful of 1-in. or $1\frac{1}{4}$-in. steel wire brads. If the side of the boat is vertical the batten will lay flat against it, but you can readily see that if the side of the boat is rounding under—as it is at the turn of the boat's bilge—the batten, if nailed flat, as shown in Fig. 5, will incline to curl up at the ends; this is what you must guard against. Let only the upper edge of the batten touch the planks and send the brad diagonally through it into the planking so it holds the batten as shown in Fig. 6. By keeping the batten vertical it will help to make the line a true, straight one as you bend it around.

Scratch the water line in with an awl or compass point deep enough so that it will show through one or two prime coats of paint to guide you when you paint the last finishing coat. When you paint, remember to do the top coat before you do the last coat of bottom paint, for two reasons: One is that the thick copper paint generally used on bottoms of boats will cover the edges of the white more completely, but the principal reason is that the paint will run up hill, and you can cut out the line sharp and distinct with no fear of the paint running into the other coat, as it is sure to do with a brush full of paint held up and trying to cut out the line clearly from above. Drops of paint are sure to run down and spoil the line.

Valve Operating Device for Gas Engines

The accompanying sketch shows how to make a valve operating device that can be supplied to almost any make of gas engine on the market after the old valve operating cams, gears, etc., have been worn out. The valve box, V, with valve and piston, can be made by anyone owning a lathe. The operation is shown by the cut: when the explosion takes place and drives the piston outward until it reaches the end of the stroke, the piston uncovers a small

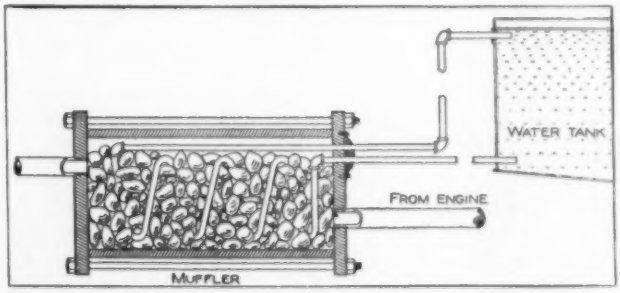


opening at T into which the pressure enters and is led by the pipe P to the valve box. The pressure now operates on the disc of the valve rod, A, pushing it inward until the exhaust valve, B, is opened. The burnt gases then rush out and operate on the piston or disc, A, until it is lifted far enough to allow the exhaust or burnt gases to pass out at D. So long as the exhaust passes the valve B, the piston A will be held in and the valve B kept open. As soon as the cylinder is clear, the spring C closes the valve ready for another explosion. With this device it is impossible for the engine to throw out an unburnt charge of gas, as it must explode in order to open the valve.—Contributed by Geo. McVicker, North Bend, Neb.

Flux for Use in Melting Brass

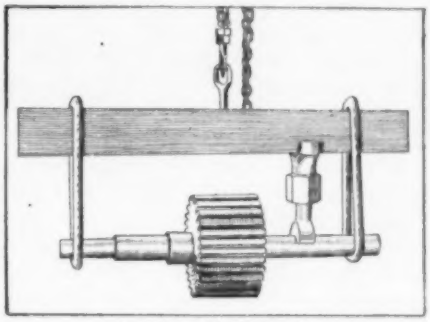
Most fluxes used in melting brass attack the crucible and cause all sorts of trouble. Glass has been used to some extent for this purpose by rolled brass manufacturers, who are able by this means to reduce the spelter loss to below 1 per cent, says the American Machinist. One reason for the success of glass as a flux is that it does not become actually liquid, and hence does not attack the crucible. It becomes pasty and is readily skimmed off, this being a difficult operation with a liquid flux.

Sulphur in powdered form mixed with oil makes one of the best things for hot bearings.



Straightening Armature Shafts

The straightening of armature shafts is a kink that sometimes troubles shop men. The accompanying illustration shows an armature shaft bender which is made from a large bar of metal, two large links and an expanding block.



Armature Shaft Bender

The screw on the expanding block has a fine thread so that the pressure can be applied slowly and evenly, says Electric Traction Weekly. The block can be moved to any point on the shaft so that the pressure may be effective between any two points on the shaft. The operation of the device is readily appreciable from the illustration shown.

A Muffler Water Heater for Explosive Engines

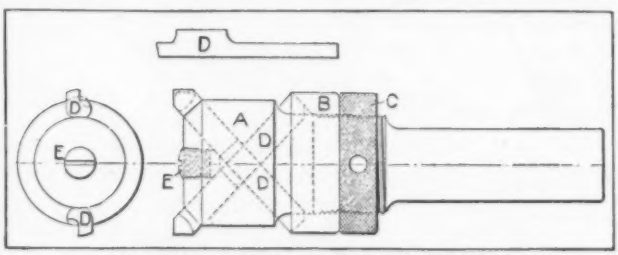
Where gas, gasoline or other explosive engines are used, a water heater coil can be connected within the muffler to heat water as a convenience for washing or other purposes. In each case the method of construction may be different according to conditions, says a correspondent of Power. The cut represents one that was made from a piece of cast-iron column 10 in. in diameter and cut 16 in. long, with two square pieces of cast-iron foot-plates clamped across each end with six $\frac{5}{8}$-in. bolts. Holes were

drilled and tapped for the exhaust inlet and outlet; the two for the water pipes connecting the coil were drilled and two holes to correspond with them were drilled through an old cast-iron tea-kettle lid. The space in the hollow of the lid was filled with asbestos fiber and the cap screws screwed down, making a serviceable stuffing box. The interior of the cylinder was filled with cobblestones from the size of an egg to the size of one's fist. These were packed tightly about the coil and answer for absorbing and delivering the heat to the pipes; also as a muffler.

The piping should be connected to the water tank with considerable distance to insure circulation. The pipe used for this was ¼-in. common black gas pipe. The tank holds 7 gal. water, which can be heated to the boiling point. The cover for the tank was weighted so as to give a little pressure to hasten the heating. This size of heating apparatus was used on an 8-hp. engine.

An Expanding Boring Tool

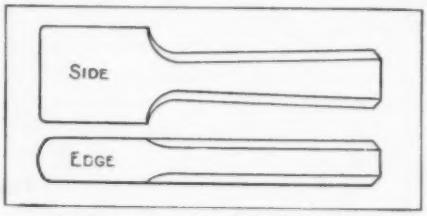
The illustration shows an expanding boring tool which is used in a turret lathe. The tool can also be used in a common lathe or drill press, but it is especially adapted for boring cored holes and used in a turret lathe. The shank, A, is made from mild steel, turned to fit the turret and threaded 14 threads per inch on the shoulder for the nut, C, and collar, B, which is bored to a sliding fit over the threads, and is casehardened. The holes for the cutters are ⅜ in. in diameter and cross each other, says a correspondent of American Machinist. The cutters are made from ⅜-in. round steel and are cut down to the center line, so as to cross each other as shown at D. After the cutters are made and hardened, they are put in place and adjusted to a trifle over the desired size and locked with the screw E. They are ground to the size in a grinding machine and then backed off.



Used in Turret Lathe for Boring Cored Holes

Tool for Expanding Babbitt Box Linings

There are several causes for babbitt linings in boxes coming loose and when they get loose, from whatever cause, there is trouble with the machine until it is fixed, says the Wood-Worker. The



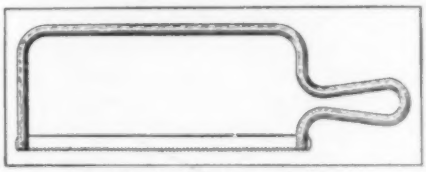
For Tightening Loose Babbitt Linings

usual method is to rebabbitt, but a temporary repair can be made by expanding the inner surface of the box, thus causing the babbitt lining to spring outward and become solidly fixed in the casting again. A tool that is used for this purpose can be made from a piece of steel ½ in. thick, 1⅛ in. wide and 4 in. long. In general appearance it resembles a saw filer's upset swage, but differs from the swage in the working end or face of the tool, which is rounded to a small radius across the face, and the corners rounded off all the way around the face, so there will be no sharp edges to cut the face of the box. Two views of the tool are shown in the sketch, one showing the side, the other the edge. The corners are ground off after the end is rounded to the desired radius.

There should be two of these tools, one to be of larger radius than the other, the smaller one for journal bearings up to about 1¼ in., the other for larger sizes. A light hammer should be used to strike the tool, one not weighing more than 6 or 8 oz., and it should be used very lightly all over, then repeat if necessary.

A Home-Made Hacksaw Frame

A quickly made hacksaw frame can be constructed by using a piece of ½-in. round iron bent in the shape shown in the sketch. If mild steel is used, the bending may be done cold in a vise. Each end of the rod is slotted to receive the ends of the saw blade. A small hole is drilled through each slotted end in which to insert a pin. The



Quickly Made Hacksaw Frame

frame should be made a trifle long so it will be necessary to spring it when putting in the blade.

How to Tighten Loose Wagon Wheel Spokes

When a wagon wheel tire is to be reset, a good method of tightening the spokes is to split the tenon of the spoke with a wood chisel, drive a wedge tightly into the split tenon and saw the remaining end of the wedge off close to the felly. This will make the spoke fit tight when the tire is reset.—Contributed by Wm. Van Der Clock, Paterson, N. J.

Apply soapsuds with a small brush to joints or fittings in an air pressure system to find leaks. It makes no difference how small the leak may be it will at once show up by the foaming soap bubbles.

Truck Desk for a Shop Foreman

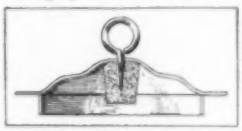
The shop foreman usually has his desk fastened to the wall where it will

Can be Moved About the Shop

be centrally located for his division of the shop. In many cases he will have to make several trips to the desk for things forgotten. The accompanying sketch explains itself. The desk complete with several drawers is mounted on large casters which makes it possible to move the whole outfit to any place on the floor, says Drafting. Special tools are kept in the lower drawers, while time sheets, memoranda, etc., can be kept under lock and key at the top of the cabinet.

How to Repair Kettle Covers

Tin kettles are so cheap that it does not pay to take one to a tinner for repairs. In many instances the knob breaks loose from the cover. When such is the case, the best thing to do, if one has not a soldering outfit, is to run an eye screw through the cover and into a good strong cork placed inside of the cover as shown in the sketch.



It is estimated that the total cost of coal and its transportation for the trip of the "Battle Fleet" around the world will be $5,000,000.

Cement and Concrete Lining of Ditches

A certain water company in southern California has lined its main canal and laterals with a thickness of concrete varying from 4 in. for the larger canal to 2 in. for the smaller laterals. The work of lining was done very thoroughly and with great care. If the canal was of an old earth ditch it was prepared for the lining and carefully finished as described. If the canal had to be constructed and then lined the excavation was made with shovels, and the excavation given an irrigation to settle and soften the ground. The excavated cross-section was made larger than the finished cross-section by the thickness of the lining, says the Irrigation Age. The bottom of the ditch was carefully graded and tamped so as to give a solid, smooth surface. A wooden form in the shape of a trough with no bottom is placed in the bottom of the ditch. This wooden form is 16 to 20 ft. long, depending on the size of the ditch, and to make it rigid the frames on which the side mold boards are nailed are placed every 2 ft. apart, as shown in Fig. 1. The trough is placed in such a position that the axis of the ditch coincides with the axis of the form. Moist earth from the excavation is shoveled behind this form and is well tamped in successive layers; at least 6 in. of earth is packed solidly in this manner, as shown in Fig. 2. The earth form is now removed and before the earth has had time to dry the lining is put in.

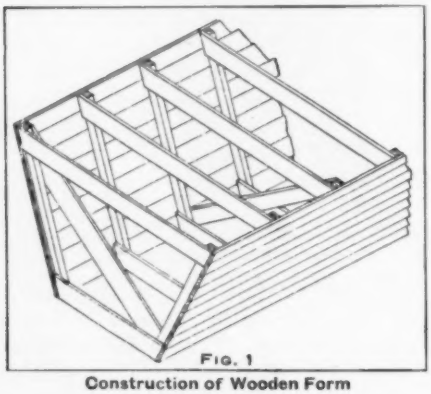


FIG. 1

Construction of Wooden Form

Another form, smaller than the earth form, is used for the lining. For use in some of the laterals this form was given a peculiar shape with the idea of strengthening the lining and giving the ditch a slightly curved form at the bottom, the corners being rounded as shown in Figs. 3 and 4. The form is built with the usual side slopes of $\frac{1}{2}$ to 1; the slope is made flatter for the lower 8 in., where a slope of 1 to 1 is used. The depth of the form is equal to the depth of the lined section plus the thickness of the concrete. The form for larger canals is similar to the earth form. It is placed on the bottom of the finished earth ditch and properly aligned; the concrete, which is mixed rather wet, is now thrown in the space between the form and the earth and well tamped. The side lining having been completed, the form is removed and the bottom lining put in. Wherever possible the concrete is kept wet while setting by allowing water to run in the ditch and retaining it with earth dams.

The concrete is made of 1 part cement to 7 parts of coarse gravel of varying sizes. The main canal which was lined has a bottom width of 5 ft., a depth of $4\frac{1}{2}$ ft., and the thickness of the lining is 4 in. Some of the smaller laterals are 8 in. at the bottom and 18 in. deep, with a lining 2 in. thick.

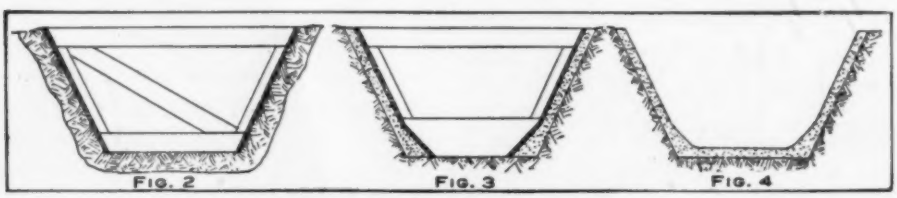
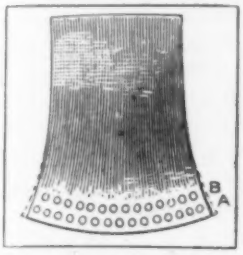


FIG. 2 FIG. 3 FIG. 4

Successive Operations in Lining the Ditch

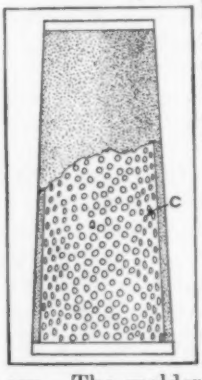
How to Upset an Axe

Heat the axe to a bright yellow and hammer as shown at A in the sketch. Turn over and proceed in the same manner on the other side, then heat again and hammer at B. Hammer at a low heat when finishing so as to leave a smooth surface, says the Blacksmith and Wheelwright. Do not strike edgewise, but trim off all the superfluous metal. File smooth and heat to a cherry red. Lay ¾ in. from the edge. Plunge into a slack tub, edge first, until cold. This will harden the axe and the next is to temper. Blow up your fire and, after brightening the axe, hold over the fire and draw to a blue color and cool off and the job is done. Be careful not to draw the heat too fast at the edge, or it may be too soft in the edge or too hard ½ to ¾ in. from the edge.



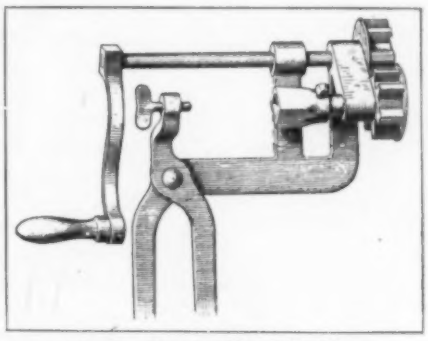
Green Sand Cores Used in Molding

Sometimes in foundries practically a very small thing will vex the molder and cause him to leave his job, as a good man does not want to make work for the scrap pile. This happened to be the case where the foreman was baffled as well as the molder. It was in the making of some tapering columns which were to be made in a green sand mold, with a green sand core made on a perforated barrel, as shown, and the whole cast on end, says a correspondent of Southern Machinery. The molder started out to make the castings and was very successful. But in a few days he commenced to have bad luck, as he called it, but the foreman insisted that he go ahead, and the molder laid off. Next morning the molder was at his post and all the castings were good again. He happened to think that the clay cores, on which the green sand was placed, had vent holes C and the possibility that these had become stopped up. They were cleaned out and the castings came out all right.



Home-Made Tire Bolting Machine

The accompanying sketch shows the construction of a home-made tire bolting machine. The cog wheels from an old clothes wringer were used for the gears, and the shaft for the handle



Showing Construction of Machine

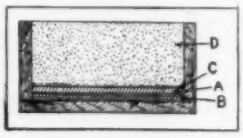
turns in a bearing made from a buggy shaft eye, says a correspondent of Blacksmith and Wheelwright. The wrench is made in different sizes for $\frac{3}{16}$, ¼ and $\frac{5}{16}$-in. nuts and put on with a set screw.

How to Find the Length of a Belt

The length of a belt may be found by adding the diameter of the two pulleys together and dividing the result by 2 and multiplying the quotient by 3¼. Add the product to twice the distance between the centers of the shaft and you will have the length of the belt required.

How to Marbleize Concrete

To produce a concrete face that will have the appearance of sanded finish marble, such as used for exterior building stone, is very successfully done on any face-down block machine by first covering the face to the depth of $\frac{1}{8}$ in. with a dry mixture of 1 part cement to 3 parts marble dust, and the regular dampened concrete is then placed upon it and tamped in the usual way, sufficient moisture penetrating the dry facing to produce a hard face. When this method is applied to rock-face molds it is necessary to first paint the face of the mold with a coat of Japan dryer, which must be hard before using the mold, says American Carpenter and Builder.



Marble dust from the Vermont quarries produces the smoothest surface, but is more troublesome in adhering to the mold than Georgia marble dust, which is of a flint or crystalline nature. Facing made as above may be polished or glossed after the blocks are five or six weeks' old by polishing much the same as natural marble.

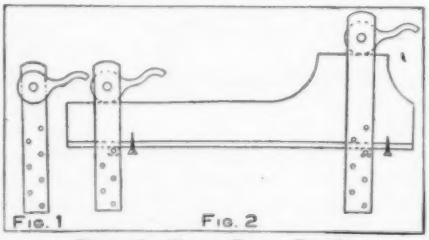
A cheaper method of producing polished or glossed marble surface is to construct a mold as shown in the sketch, which is the same as any ordinary artificial stone mold, except that on the bottom or face side is placed a polished plate glass, A, which rests on a rubber blanket or mat, B, to save breaking the glass when tamping. On the glass is poured to the depth of $\frac{1}{8}$ in. a composition made of 1 part Portland cement and 3 parts marble dust, C, mixed with sufficient water to admit pouring. This composition must be well agitated until poured, which is immediately covered with rather a dry concrete block composition, D, which must be well and carefully tamped, and the mold left undisturbed for at least one day, when the block or slab is removed and seasoned.

When a highly polished glass and fine marble dust is used the surface is perfect, and it sometimes is necessary to slightly warm the glass to free the block from it. Such surface can be highly glossed by vigorous rubbing with felt frequently dampened with a solution of 1 part oxalic acid to 6 parts clean water. All acids must be washed off the block with clean water as soon as the desired gloss is obtained.

A Wagon Maker's Clamp for Holding Frame Panels

The accompanying sketch shows a very simple device which can be used to hold the panels on a wagon frame until they are fastened together by means of wood screws, says a correspondent of the American Blacksmith. It is constructed entirely of wood, with the exception of the bolts.

Secure two pieces of wood about 4 ft. long, 4 in. wide and 2 in. thick, and in one end bore several holes about 3 or 4 in. apart, as shown in Fig. 1.



Clamp for Wagon Frame Panels

Near the other end of each piece bore a hole and fasten a clamp with a bolt. When this is done, the next step to be taken is to construct two pieces of wood about 3 in. square and 6 in. long, with pegs projecting out on one end about 2 in. These pegs should not be directly in the center, but a little to one side, or, in other words, a little off center, so that it can be turned in four different ways when regulating the length of the clamp, the holes in some cases not being close enough together to properly adjust every length. As can be readily seen in Fig. 2, this is a very simple and convenient device for

holding panels on the frames, and should prove very useful to the wagon builder.

How to Save Monograms When Repainting

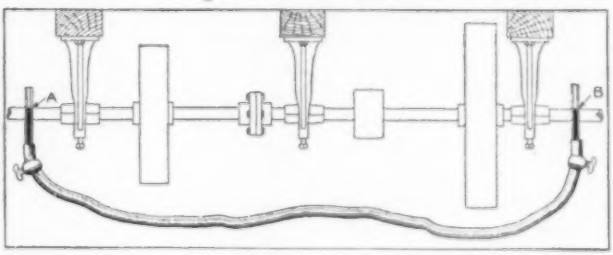
On carriage body panels there is frequently a small monogram or ornament which contains much fine work. If the panel can be repainted without having to replace the ornament again much time may be saved, says the Master Painter. The following is a method by which such an ornament may be saved:

When lead coloring the work, avoid the monogram and leave it untouched until the job is ready for quick color. At this stage mix some ordinary soap to a paste with water, and with a writing pencil carefully cut in and coat over twice with the soap the portion required to be saved. When this is done put the quick and varnish colors on over the soaped portions and all, as though you had no intention of saving them. Next day, when flatting the varnish down, it will be found that the color on the soaped portions easily breaks away, leaving the monogram standing out in its original state.

How to Level a Line Shaft

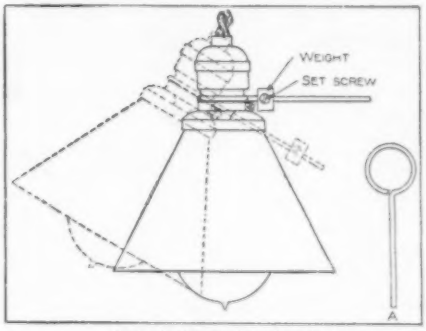
Millwrights have a hard time to level up shafting after it has been in use for some time, due to the sagging of the overhead joist. In a great many places the pulleys are so close together that a spirit level cannot be placed on the shaft and the only way that seems possible is to take the shaft down and run a line through the hanger bearings, which requires considerable time.

The sketch herewith illustrates a good way, as it is based on the principle of "water will find its own level." By taking a small rubber tube or hose and attaching two small cocks and a water glass on each end, and filling the entire length with water, the shaft can then be made level where it is found to sag by noting the water level in the glass tubes as shown at A and B. Shafts not in line require 25 to 50 per cent more power than if they were in line.—Contributed by Geo. W. Richardson, Chicago.



Angle Adjuster for Electric Drop Lights

Electric lights that are suspended by a flexible drop cord from the ceiling are not usually in the best position for close office work. A simple method of giving the globe the proper angle is



Adjustable to Any Angle

to procure a piece of heavy wire and bend it around the socket just above the shade holder so that it will fit tightly. Allow about 5 or 6 in. to extend out at right angles to the socket. Take a small block of round or square bar, or rod, and drill a hole through it large enough to fit the wire. At right angles to this drill another hole and tap it for a machine or set screw. By sliding the weight block along the wire and tightening the set screw at the proper position the shade and lamp will

be tilted so as to direct the light at the desired angle. The wire is formed in the shape shown at A in the sketch.

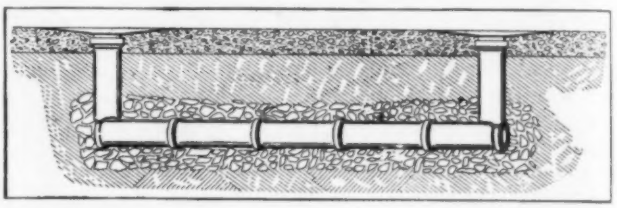
How to Drain a Boiler Room Floor

The old floor of our boiler room was made of plank laid on stringers resting on the ground. The floor naturally wore, rotted and was eaten out by the rats, says a correspondent of Power. It was decided to place a floor in that would last as long as the plant and consequently a floor was constructed of cement concrete. As this made a perfectly tight floor the question came up of how to take care of the several drips usually found around a boiler room.

After tearing out the old wooden floor a trench was excavated a trifle less than 2 ft. deep and about 1 ft. wide for the proper length in front of the boilers. In the bottom of this trench was laid a layer of about 3 in. of loose broken stone from 2 to 4 in. long. On top of this stone was laid a series of unglazed 4-in. drain tile such as used for draining swamps and low places. Around these tile and on top of them was placed more broken stone, about filling the trench half full, and at each end a length of tile was stood on end reaching to within 1 in. of the completed floor level. It will be noticed in the sketch that the two end sections of the horizontal series of drain tile were roughly beveled off by breaking with a chisel and hammer in order to form a rough sort of an elbow, the loose stone surrounding this point being chosen to fill in without falling into the space between the vertical and horizontal sections. After having placed all these parts of the drainage system, a layer of clay-like earth was placed in the trench to bring the level up to the bottom line of the floor layer. The floor was then laid over this trench the same as the rest of the boiler room, with the exception that surrounding these vertical drainage holes it was sloped down for about 12 in. each way to carry water toward the holes. This made a perfect drainage that has given entire satisfaction.

How to Clean Raised Gold Leafed Letters

Dust the letters off with a soft brush and wash them with castile soap suds, also using a soft brush, after which wash with plenty of clean water, to remove all soap. A wad of cotton will be the safest to use. Allow the work to dry, then if needed, restore luster by washing with dilute sulphuric acid, making the water quite acid, but not too strong, says the Master Painter. Oxalic acid will also answer the purpose.



Removing Cinders from the Eye

The best way to remove particles of dirt or cinders from the eye is to secure a raw potato and cut a very thin slice, about $^1/_{32}$ in. thick and $\frac{1}{4}$ in. wide. Slip this under the eyelid and the cinder will adhere to the potato. The potato being cool and moist will not hurt the eye.

Rifle barrels that are leaded can be cleaned by stopping up one end of the barrel and filling with mercury. Allow this to remain in the barrel 24 hr. and then return the mercury to a bottle for future use. Wipe out the barrel with a piece of linen cloth oiled. The mercury will clean out the lead.

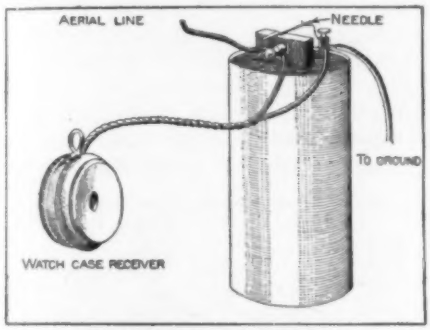
Screws may be kept from getting rusty and sticking tight by applying graphite mixed with ordinary oil.

Amateur Mechanics

How to Make a Simple Wireless Telegraph

By Arthur E. Joerin

An efficient wireless telegraph receiving apparatus for short distances up to 1,000 ft. may be constructed in the following manner: Attach a watch case telephone receiver to a dry cell or battery of any make. The negative pole



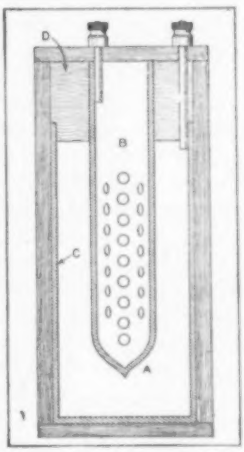
For Distances up to 1000 Feet

or zinc of the cell is connected to a ground wire. This is done by attaching to a gas or water pipe. The positive pole or carbon of the cell is connected to the aerial line. This aerial collector can be made in various ways, either by using a screen wire or numerous wires made in an open coil and hung in the air. File a V-shaped groove in the upper end of the carbon of the cell. Attach a small bent copper wire in the binding-post that is attached to the zinc of the cell. In the bend of this wire and the V-shaped groove filed into the carbon, lay a needle. This will complete the receiving station. Use a spark coil in connection with a telegraph key for the sending station, making a ground with one wire and have the other connected with another aerial line.

By connecting the telephone receiver to the cell and at the same time having a short circuit a receiving station is made. As the telephone offers a high resistance, part of the current will try to take the shorter high resistance through the needle. If the waves strike across the needle, the resistance is less and thus less current travels through the telephone receiver. If the wave ceases, the resistance between the needle and the carbon is increased and as less current will flow the short way, it is compelled to take the longer metallic way through the windings of the receiver which will cause the clickings that can be read.

How to Make a Small Storage Battery

The cell of a storage battery consists of two plates, a positive and a negative, made of lead and placed in a dilute solution of sulphuric acid. Large batteries made of large cells have a great number of plates, both positive and negative, of which all positive plates are connected to one terminal and the negative plates are connected to the other terminal. The storage cell as described below is the right size to be charged by a few gravity cells and is easily made.



Secure a piece of 1¾-in. lead pipe, 5 in. long, and cut both ends smooth and square with the pipe. Solder a circular disc of lead to one end, forming a cup of the pipe. As this cup must hold the sulphuric acid it must be perfectly liquid tight. It is necessary to get another lead pipe of the same length and ¾-in. in diameter. Bore as many ⅛-in. holes in this pipe

as possible, except for about 1 in. on each end. One end of this tube is hammered together as shown at A in the sketch to make a pocket to hold the paste. This, of course, does not need to be watertight.

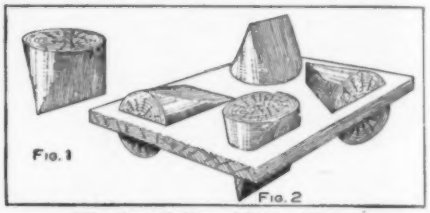
A box of wood is made to hold the larger tube or cup. This box can be square, and the corners left open around the cup can be filled with sawdust. A support is now made from a block of wood to hold the tube, B, in place and to keep it from touching the cup C. This support or block, D, is cut circular with the same diameter as the lead cup C. The lower portion of the block is cut away so it will just fit inside of the cup to form a stopper. The center of this block is now bored to make a hole the same size as the smaller lead pipe. Place the lead pipe in the hole and immerse it in smoking hot paraffine wax, and leave it until the wood has become thoroughly saturated with the hot wax. Use care to keep the wax from running on the lead at any place other than the end within the wood block. Two binding-posts should be attached, one to the positive, or tube B, and the other to the negative, or tube C, by soldering the joint.

A paste for the positive plate is made from 1 part sulphuric acid and 1 part water with a sufficient amount of red lead added to make of thick dry consistency. When mixing the acid and water, be sure to add the acid to the water and not the water to the acid. Also remember that sulphuric acid will destroy anything that it comes in contact with and will make a painful burn if it touches the hands. Stir the mixture with a stick and when a good dry paste is formed, put it into the smaller tube and ram it down until the tube is almost filled. The paste that may have come through the holes is scraped off and the tube set aside to dry. The large tube or cup is filled with a diluted solution of sulphuric acid. This solution should be about one-twelfth acid. The cell is now complete and ready for storing the current.

The cell may be charged with three gravity cells. These are connected in series and the positive terminal binding-post on the storage cell is connected to the wire leading from the copper plate in the gravity cell. The other plate is connected to the zinc. The first charge should be run into the cell for about one week and all subsequent charges should only take from 10 to 12 hours.

Fitting a Plug in Different Shaped Holes

A certain king offered to give the prince his liberty if he could whittle a plug that would fit four different-shaped holes, namely: a square hole, a round one, an oblong one and a triangular one, says the Pathfinder. A broomstick was used to make the plug and it was whittled in the shape shown

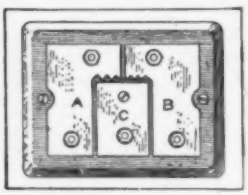


Fits Four Different Shaped Holes

in Fig. 1. The holes in the different places as shown in Fig. 2, were fitted by this one plug.

How to Make a Lightning Arrester

Secure a piece of wood about 3½ in. square that will furnish a nice finish and round the corners and make a small rounding edge as shown in the sketch.



From a piece of brass $\frac{1}{16}$ in. thick cut two pieces alike, A and B, and match them together, leaving about $\frac{1}{16}$ in. between their upper edges and fasten them to the wood with binding-posts. The third piece of brass, C, is fitted

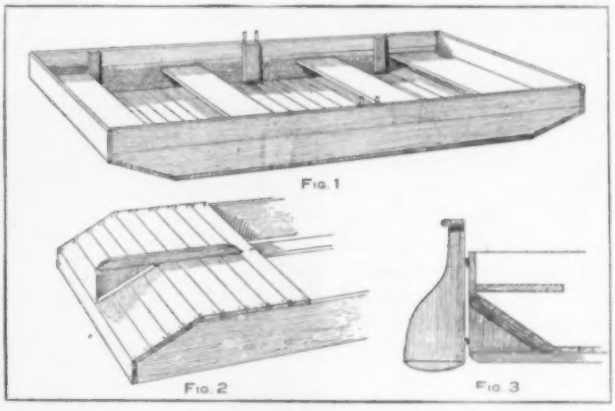
between the pieces A and B allowing a space of $\frac{1}{16}$-in. all around the edge. One binding-post and a small screw will hold the piece of brass, C, in place on the wood. The connections are made from the line wires to the two upper binding-posts and parallel from the lower binding-posts to the instrument. The third binding-post on C is connected to the ground wire. Any heavy charge from lightning will jump the saw teeth part of the brass and is grounded without doing harm to the instruments used.—Contributed by Edwin Walker, Chicago, Ill.

A Home-Made Punt

A flat bottom boat is easy to make and is one of the safest boats, as it is not readily overturned. It has the advantage of being rowed from either end, and has plenty of good seating capacity.

This punt, as shown in Fig. 1, is built 15 ft. long, about 20 in. deep and 4 ft. wide. The ends are cut sloping for about 20 in. back and under. The sides are each made up from boards held together with battens on the inside of the boat near the ends and in the middle. One wide board should be used for the bottom piece. Two pins are driven in the top board of each side to serve as oarlocks.

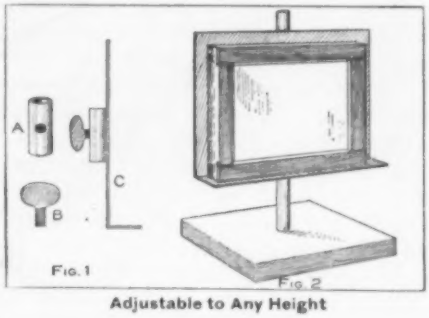
The bottom is covered with matched boards not over 5 in. wide. These pieces are placed together as closely as possible, using white lead between the joints and nailing them to the edges of the side boards and to a keel strip that runs the length of the punt, as shown in Fig. 2. Before nailing the boards place lamp wicking between them and the edges of the side boards. Only galvanized nails should be used. In order to make the punt perfectly watertight it is best to use the dryest lumber obtainable. At one end of the punt a skag and a rudder can be attached as shown in Fig. 3.



Easy to Build and Safe to Use

Photographers' Printing Frame Stand

When using developing papers it is always bothersome to build up books or small boxes to make a place to set the printing frame in front of the light. Details for making a small stand that is adjustable to any desired height are shown in the sketch. In Fig. 1 is shown the construction of the sliding holder. A piece of $\frac{1}{4}$-in. gas pipe, A, is cut 1 in. long and fitted with a thumbscrew, B. The piece of pipe is soldered to the middle on the back side of a piece of metal that is about 4 by $4\frac{1}{2}$ in. with its lower edge turned up to form a small shelf as shown at C. The main part of the stand is made by inserting a $\frac{5}{16}$-in. rod tightly into a block



Adjustable to Any Height

of hard maple wood that is 1 in. thick and 3½-in. square (Fig 2). The pipe that is soldered to the metal support will slide up and down the rod and the thumbscrew can be set to hold it at the desired point.

Heat and Expansion

Take an electric light bulb from which the air has not been exhausted and immerse it in water and then break off the point. As there is a vacuum in the bulb it will quickly fill with water. Shake the bulb gently until a part of the water is out and then screw the bulb into a socket with the point always downward. Apply the current and the heated air inside will soon expand and force the water out with great rapidity. Sometimes this experiment can be done several times by using the same bulb.—Contributed by Curtiss Hill, Tacoma, Wash.

Photographing a Streak of Lightning

The accompanying illustration is a remarkable photograph of a streak of lightning. Many interesting pictures of this kind can be made during a storm at night. The camera is set in a place where it will not get wet and left standing with the shutter open and the plate ready for the exposure. Should a lightning streak appear within the range of the lens it will be made on the plate, which can be developed in the usual manner. It will require some attention to that part of the sky within the range of the lens so as to not make a double exposure by letting a second flash enter the open lens.—Contributed by Charles H. Wagner.

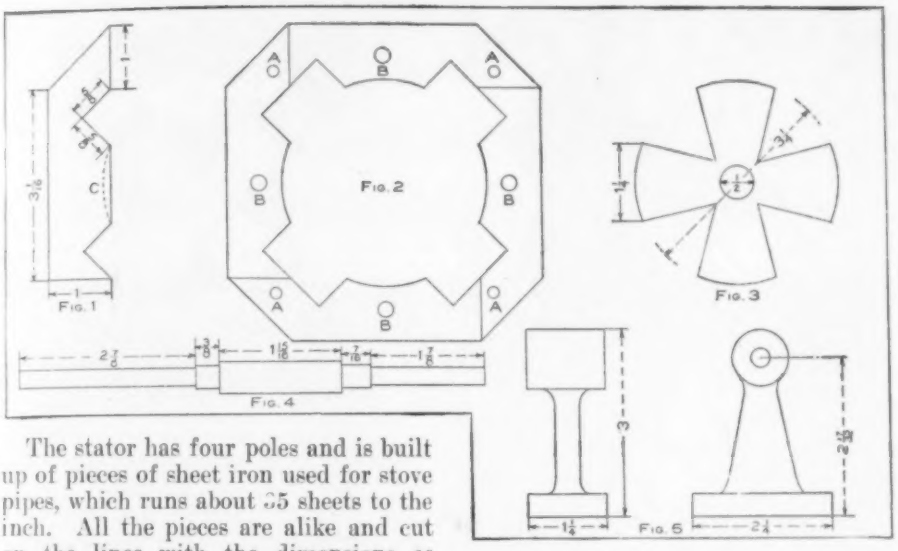
Borax may be used as a solvent for shellac gum.

How to Make a Small Single-Phase Induction Motor

By C. H. Bell

The following notes on a small single-phase induction motor, without auxiliary phase, which the writer has made, may be of interest to some of our readers, says the Model Engineer. The problem to be solved was the construction of a motor large enough to drive a sewing machine or very light lathe, to be supplied with 110-volt alternating current from a lighting circuit, and to consume, if possible, no more current than a 16-cp. lamp. In designing, it had to be borne in mind that, with the exception of insulated wire, no special materials could be obtained.

The principle of an induction motor is quite different from that of the commutator motor. The winding of the armature, or "rotor," has no connection with the outside circuit, but the current is induced in it by the action of the alternating current supplied to the winding of the field-magnet, or "stator." Neither commutator nor slip rings are required, and all sparking is avoided. Unfortunately, this little machine is not self-starting, but a slight pull on the belt just as the current is turned on is all that is needed, and the motor rapidly gathers speed provided no load is put on until it is in step with the alternations of the supply. It then runs at constant speed whether given much or little current, but stops if overloaded for more than a few seconds.



The stator has four poles and is built up of pieces of sheet iron used for stove pipes, which runs about 35 sheets to the inch. All the pieces are alike and cut on the lines with the dimensions as shown in Fig. 1, with the dotted line, C, to be filed out after they are placed together. Each layer of four is placed with the pointed ends of the pieces alternately to the right and left so as to break joints as shown in Fig. 2. The laminations were carefully built up on a board into which heavy wires had been driven to keep them in place until all were in position and the whole could be clamped down. In the middle of the pieces ¼-in. holes, B, were then drilled and ¼-in. bolts put in and tightened up, large holes being cut through the wood to enable this to be done. The armature tunnel was then carefully filed out and all taken apart again so that the rough edges could be scraped off and the laminations given a thin coat of shellac varnish on one side. After assembling a second time, the bolts were coated with shellac and put into place for good. Holes 5-32 in. in diameter were drilled in the corners, A, and filled with rivets, also varnished before they were put in. When put together they should make a piece 2 in. thick.

This peculiar construction was adopted because proper stampings were not available, and as every bit of sheet iron had to be cut with a small pair of tinners' snips, it was important to have a very simple outline for the pieces. They are not particularly accurate as it is, and when some of them got out of their proper order while being varnished, an awkward job occurred in the magnet which was never entirely corrected. No doubt some energy is lost through the large number of joints, all representing breaks in the magnetic circuit, but as the laminations are tightly held together and the circuit is about as compact as it could possibly be, probably the loss is not as great as it would appear at first sight.

The rotor is made of laminations cut from sheet iron, as shown in Fig. 3, which were varnished lightly on one side and clamped on the shaft between two nuts in the usual way. A very slight cut was taken in the lathe afterwards to true the circumference. The shaft was turned from ½-in. wrought iron, no steel being obtainable, and is shown with dimensions in Fig. 4. The bearings were cast of babbitt metal, as shown in Fig. 5, in a wooden mold and bored to size with a twist drill in the lathe. They are fitted with ordinary wick lubricators. Figures 6 and 7 are sections showing the general arrangement of the machine.

The stator is wound full with No. 22 double cotton-covered copper wire,

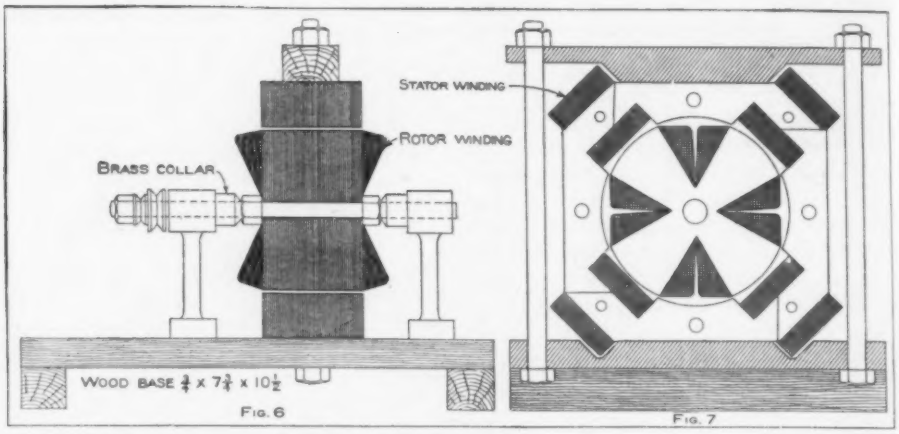


Fig. 6 Fig. 7

about 2½ lb. being used, and the connections are such as to produce alternate poles—that is, the end of the first coil is joined to the end of the second, the beginning of the second to the beginning of the third, and the end of the third to the end of the fourth, while the beginnings of the first and fourth coils connect to the supply.

The rotor is wound with No. 24 double cotton-covered copper wire, each limb being filled with about 200 turns, and all wound in the same direction. The four commencing ends are connected together on one side of the rotor, and the four finishing ends are soldered together on the other. All winding spaces are carefully covered with two layers of cambric soaked in shellac, and as each layer of wire was wound, it was well saturated with varnish before the next was put on.

This type of motor has drawbacks, as before stated, but if regular stampings are used for the laminations, it would be very simple to build, having no commutator or brushes, and would not easily get out of order. No starting resistance is needed, and as the motor runs at constant speed, depending upon the number of alterations of the supply, a regulating resistance is not needed.

The pain of carbolic acid burns can be relieved promptly by washing with alcohol, if applied immediately. If too late for alcohol to be of use, brush with water containing saturated solution of picric acid.

How to Make a Paper Book Cover

Book covers become soiled in handling and especially school books. Various methods are applied for making a temporary cover that will protect the book cover. A paper cover can be quickly made by using a piece of paper larger than both covers on the book when they are open. Fold the paper on the long dotted line, as shown in Fig. 1. When the folds are made the paper should then be just as wide as the book cover is high. The ends are then folded on the short dotted lines, which will make it appear as shown in Fig. 2. The paper thus folded is placed on the book cover as shown in Fig. 3—Contributed by C. E. McKinney, Jr., Newark, N. J.

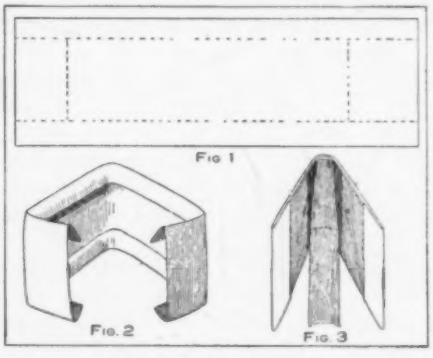


Fig. 1 Fig. 2 Fig. 3

To Protect Book Covers